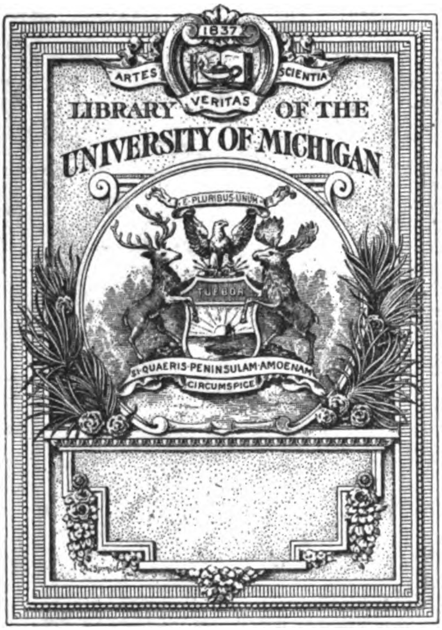
Journal of the New York Botanical Garden

New York Botanical Garden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First Assistant

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COLLECTING CACTI IN SOUTHERN MEXICO.

Dr. N. L. Britton,

Director-in-Chief,

New York Botanical Garden.

Dear Sir: — In accordance with the agreement by which the Department of Botanical Research of the Carnegie Institution of Washington is to aid in the investigations of the Cactaceae by yourself and Dr. J. N. Rose, 31 cases of living specimens were shipped to you from Tehuacán, Puebla, *via* Vera Cruz, on Sept. 13, 1906. Some of the specimens included are of massive size, and if induced to grow in New York will soon furnish material to illustrate their entire life-history. A set of photographs illustrating the habits of many of the species is being sent you by mail.

In connection with the activities of the Desert Laboratory an effort is being made to obtain a comprehensive idea of the vegetation of the arid areas of the continent with especial regard to the composition of the flora, the factors affecting distribution, and the general physiological behavior of the more highly specialized forms. A study of several localities in southern Mexico with these ends in view was made in August and September, 1906, and I was so fortunate as to do this work in company with Dr. J. N. Rose, who is engaged in a taxonomic study of the flora of the regions in question. This arrangement greatly facilitated my own work, and by our joint efforts a large number of species were secured, some of which are as yet undescribed, and many have

FIG. 1. Pit in the Pedregal. Pepper tree (*Schinus mollis*) on one margin. The crown of *Senecio praecox* rises above the level: a Clematis climbs through the tangle of shrubbery, and an Opuntia finds a foothold on the other margin.

not previously been represented in horticultural or botanical collections.

In our first trip afield we were guided by Dr. C. G. Pringle to a locality on the lava slopes of the Pedregal, a few miles south of Mexico City. The irregular surface of this volcanic formation is pitted with cavities and caverns, some of which are large enough to enclose an ordinary dwelling house, and the variety of conditions of moisture and shade gives opportunity for a wide range of vegetation. So luxuriantly do the plants grow in these places that the openings of the caves, or pits, will be choked with their branches and foliage.

This locality has been visited by Dr. Pringle many times and

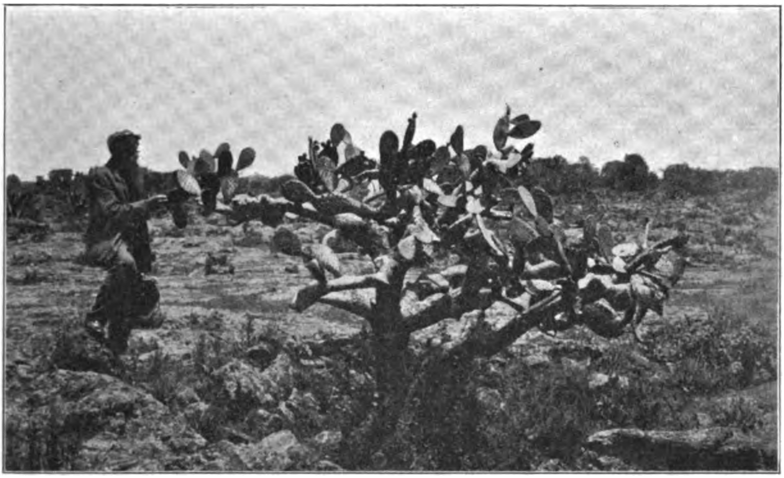

FIG. 2. *Opuntia* and Dr. C. G. Pringle.

is a type locality for many species collected by him. We found several species of prickly pear, some of which have not yet been described, and it was also seen that species so closely related as not to be easily separable were in the closest proximity.

Early in September we started to examine the desert valleys which lie along the main backbone of southern Mexico in the states of Puebla and Oaxaca at elevations of 1,200 to 6,000 feet. Tehuacán, situated in one of the northernmost of these arid valleys, was chosen as a favorable place for centering our work and assembling living plants for shipment to New York, Tucson and Washington. Headquarters were made at the Hacienda El Riego, west of the city, near the foothills of the range bounding the valley on the west. We met Mr. W. L. Morkhill, general manager of the railway, the Ferrocarril Mexicano del Sur, in his office at Puebla, and in his car at Tehuacán, and plans were made by him by which laborers and materials were secured for us by Sr. Daniel Tellez, superintendent of the tram lines of the railway system. In addition Mr. Morkhill arranged with the general manager of the Interoceanic Railway that the car loaded with plants at Tehuacán should be sent through without change or delay to the wharf at Vera Cruz where the crates could be lightered out to the steamer. It is difficult to acknowledge properly the amount of material aid and kindly coöperation received from Mr. Morkhill in this enterprise.

The town of Tehuacán lies in the middle of a valley running north and south on the eastern side of the main continental ridge, and this and the neighboring valleys and slopes are a part of one of the most striking deserts in the world, the xerophilous vegetation offering features of adaptation and distribution not previously encountered elsewhere. The abundance of the Cactaceae rivals or surpasses even that of the southern part of Arizona and of Sonora, and, a half dozen of the species being massive forms, the landscape is highly characterized by them. *Cereus Weberi*, *C. geometrizans*, *Cephalocereus macrocephalus*, *Pilocereus fulviceps*, *P. chrysocantha*, *P. tetetzo*, *Escontria chiotilla*, together with four or five other undescribed forms reach a height and attain a bulk as great or greater than the saguaro. The amount of water stored by such plants on any given area is so great that planters have actually considered the feasibility of obtaining it in quantities by crushing the plants with machinery.

Nopals, tunas, and prickly pears in general are in abundance, and here as elsewhere in Mexico more than one variety practically free from spines have been under cultivation for some time. Of the half dozen species of *Echinocactus* one forms huge mounds of small individuals as much as three yards across, while *E. grandis* might as rightly be included among the trees as the saguaro (*Cereus giganteus*).

The fruits of a large number of species of *Opuntia* and of a few of *Cereus*, are used in quantities for food and may be found in great abundance in the local markets. A few of the prickly pears produce a fruit, which is shipped long distances, and even finds a way to New York markets. A liking for these fruits is

FIG. 3. *Echinocactus grandis*, and Dr. J. N. Rose, on Rancho San Diego east of Tehuacán.

an acquired taste; probably a residence in Mexico would hasten the acquisition, the insipidity of these fruits forming a possibly welcome contrast to the fieriness of the "chile" and the corrosive effect of mescal. Many of these plants are grown around the primitive homes of the natives as apples, peaches or pears might be around a farmhouse in the United States. In addition to yielding fruits the stems make admirable hedges or barriers, although when planting for this purpose alone some species of Cereus are generally used.

The evaporation in the Tehuacán region must be much in excess of the precipitation, yet it was noticeable that the various species of *Opuntia* were to be seen growing on dirt roofs of adobe dwellings, on stone walls, and even in crevices of brick and stone high up on cathedrals and other tall buildings. The air temperatures are favorable to such exposure but the protective and regulatory devices of such plants must be of the highest kind.

No desert has yet been visited by the writer in which the storage function is so highly developed and exhibited by so many genera of plants as in the arid region of Tehuacán. In addition to the cacti, euphorbias, agaves, and related forms, the tree morning glory (*Ipomoea* sp.) has a soft thick trunk into which a knife may be easily thrust to the hilt and is chiefly a storage organ. Three species of *Beaucarnea*, relatives of the yucca, known locally as "sotol" have the bases of the trunks swollen to a thickness of seven or eight feet with a height not more than two or three times this measurement, by the formation of an immense mass of spongy tissue with great capacity for retaining water. Like many other plants showing similar adaptions these trees sit directly on the surface and may be easily pushed over, especially after dead.

On the jungly slopes we encountered *Rhus potentillaefolia*, and found its poisonous effect on the skin as virulent as that of any American species, and the results as severe and lasting.

Here as elsewhere in Mexico it was found that the broad leaves of the agave are sliced and the dried plates used in covering the huts and enramadas of the peons and Indians.

After a general preliminary reconnaisance around Tehuacán we proceeded southward by rail to Oaxaca de Juarez, where we were so fortunate as to encounter Prof. Conzatti, of the Escuela Normal, who has long been known as an ardent student of the flora of this region. From him we obtained much valuable information not only as to distribution and general features of the region, but also as to the uses of various vegetable products found in the local markets.

Oaxaca lies on an elevated plain. The precipitation in the immediate neighborhood is rather high owing to the close proximity of the mountains which act as condensers, although at an elevation but little below, the vegetation becomes distinctly xerophytic. Here it was found that the Indians and travellers in general used a peculiar storm cloak, consisting of a mat made from the leaves of a palm with three rows of overlapping thatching inserted on one side. A second pattern, not seen so often, was thatched more densely by leaving free ends of the fiber over

FIG. 4. Group of natives in storm cloaks of thatched palm.

the whole surface. With two of these carried in a roll by a cord across the shoulder the traveller was provided with clothing by day and bedding by night. Lying upon one of these waterproof cloaks with the second above him the Indian seems heedless of the fact that the legs from the knees downward were exposed to the night air.

Following the line of least resistance it was found that the facilities for travel provided for going to the ancient ruins at Mitla 35 miles to the southeast would take us into a region densely populated with cacti and affording a view of the surrounding desert. The journey was made by diligence, and the route lay through the village of Tule made famous by the giant ahuehuetl, or cypress (*Taxodium mucronatum*), which stands in the church yard. This tree by the claims of local patriotism is the greatest in the world, while for a long time it has been cited as the oldest living. Both these claims are incapable of actual proof, although the tree has much to justify an interest in it. It measures 154 feet and 2 inches six feet from the ground, but it may be really two or three individuals fused together as it divides into that

FIG. 5. View of basal portion of giant cypress of Tule, Oaxaca.

many main branches within fifty feet, as may be seen from the accompanying illustration. This tree has been an object of observation for more than two centuries, and on one side is a tablet, partly covered by the growth of the outer layers of the trunk, signed by the great naturalist, Baron von Humboldt, and probably placed there by his direction a century ago.

The road to Mitla runs down the drainage system of a tributary of the Tehuantepec river, among fields of maize and agaves, and is fringed much of the way with hedges of cacti especially in and near the villages. Among these were seen several species which seemed to lack descriptions among known records.

The village of Mitla is situated in latitute 17° N., at an altitude of about 4,000 feet, conditions which coöperate to give the vegetation a pronounced desert character. The famous ruins near by testify to the former existence of a type of civilization with the indelible impress of the desert upon it: a civilization in which coöperation or communism was carried to the greatest

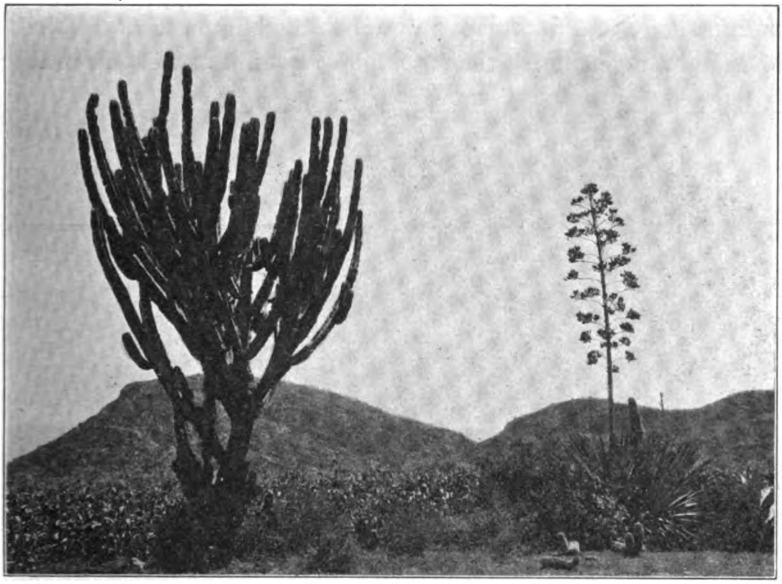

FIG. 6. Roadside scene between Oaxaca and Mitla. *Cereus eburneus*, *Cereus* sp., *Agave* and field of maize.

extreme, as it must have been among the ancient pueblos of the deserts of the United States. In the light of the conclusions of the meteorologist we may assume that no matter how long ago these ruins were peopled, yet a climate similar to that of to-day must have been experienced by the builders of the ancient temple.

Before leaving Mitla we were afforded the opportunity of inspecting a distillery for making mescal, the fiery whiskey derived from the juice of the agave. When the great rosettes of this plant (several species are used) are mature they are uprooted and the blades are cut away near the base, leaving a core made up of leaf bases and the lower end of the undeveloped inflorescence axis. A rock-lined pit is filled with the cores and baked thoroughly, and after cooling the juice is pressed out and collected in great vats of rawhide supported on a framework of mesquite branches. After a week of reeking fermentation in the open air distillation is accomplished by a crude but effective apparatus in which condensation is secured by the cooling effect of running water brought hither in earthen and wooden conduits. So far as experience and information may be relied upon the devotees of this beverage cherish the ambition to quaff it as fresh from the

FIG. 7. Agave, "chular miel," from which a tlachiquero is taking the sap for pulque. A reservoir made of the raw skin of a pig is carried on the back.

still as it is possible to get it, and before any of its stinging qualities have been lost. Several kinds or types of this fluid are made, of which one of the better quality is known as tequila.

In addition to these various preparations the production of pulque seems to be one of the profitable industries in the agriculture of Mexico. The agaves used for this purpose have the centers of the rosettes hollowed out when mature and the sap exudes by bleeding pressure into this cavity, from which it is collected and taken away once or twice daily. This is deftly accomplished by the use of a long gourd in the hands of the tlachiquero, who thrusts one end of the gourd into the liquid and puts his lips to the other perforated end and sucks, with the result that the sap is drawn into the gourd and then emptied into the whole pigskin carried upon his back. Fermentation quickly ensues and the resulting pulque is used in enormous quantities. It has the appearance of skimmed milk diluted with water and is characterized by an ill-favored odor which clings long to the person imbibing. The water supply, even in the remoter parts of central and southern Mexico is not of the best quality, and the traveler is between the danger arising from drinking from contaminated streams, and the disagreeable necessity of using the illy flavored pulque with the general result that one is endured at times and the dangers of the other are incurred when the taste of the safer beverage palls.

On the return to Tehuacán Dr. Rose and I left the train at Santa Catalina where we were met by a section crew with a push car and taken down to Tomellín, thus giving an opportunity for the examination of the vegetation at closer range than that afforded by a moving train. Many interesting and unrecognizable plants had been seen on the journey southward and we expected to secure some valuable material by the trip. In this we were not disappointed, and by the courtesy of Mr. Morkill who arranged the matter for us we experienced one of the most thrilling rides in Mexico.

The railway grade drops 2,346 feet in the descent from Sta. Catalina to Tomellín, a distance of 22 miles, running down a steeply walled cañada most of the way, crossing the stream by bridges at various angles and curves, through tunnels and around curves in a short radius made possible by the narrow gauge of the track. Our car was a wooden platform about eight or nine feet long and half as wide which rested by open, wooden U-bearings upon two pairs of car wheels. Our crew were evidently of the determination to show us that a Mexican could slide down hill as fast as an American. Standing erect the foreman used a handspike thrust through a hole in the platform against one wheel as a brake, while we sat with feet dangling from the front edge of the platform, the middle being occupied by agaves, cacti and other plants collected, while the crew formed a fringe to the rear. Within a few hundred yards the car would gain a speed of over thirty miles an hour at which rate we would dash down to the apex of a curve around a cliff, which we would round with the wheels climbing the outer rail, the track visible only a few feet ahead, and a very sufficient drop below us.

The slopes examined during our frequent stops were replete with interest. Crassulaceae were abundant, the sago-palm, *Dioon edule*, was found in the ravines, a *Beaucarnea* was abundant on the northern slopes, while in one place we faced a great hillside thickly covered with tetetzo (*Pilocereus tetetzo*), the individuals of which were as large as the giant cactus of Arizona.

Tomellín was reached in the evening, where we found shelter in the staff house of the railway by the courtesy of Mr. Morkill. Portions of two days were spent here in securing additional material and shipping all of our collection to Tehuacán. At this elevation we found the principle giant cactus to be *Cereus Weberi*, a huge form which divides a few feet from the ground into a cluster of thirty to fifty branches which may be eight or ten inches in diameter. This species, growing at an elevation of 1,200 feet in latitude 19° N., is perhaps the most tropical of the massive forms. Here was also to be found the much-branched slender *Escontria chiotilla*, also a tree.

Arriving at Tehuacán on September 8 we began immediately to complete our observations and prepare living specimens for shipment. A gang of laborers, a team, and a carpenter were kept busy for a week measuring standing cacti, by which suitable wooden jackets could be built, and packing all securely for the journey. The entire lot was assembled on a vacant piece of ground near the baths of El Riego and from there was taken to the freight station at Tehuacán on a tram car from which a transfer was made to a freight car. The latter was sealed and sent despatch to Vera Cruz. To this point Dr. Rose proceeded to attend to matters of clearance and shipment, and when the plants where safely aboard the S. S. Monterey they were accompanied to New York by Mr. Joseph Rose Jr., who had assisted in the preparations throughout.

The shipments to the Desert Laboratory came through safely and are already in use in our experimental observations.

The regions visited by Dr. Rose and myself during the trip were easy of access and many of the localities had been previously seen by Dr. Pringle, Dr. Rose, Prof. Trelease or other botanists. We had almost constantly in view, however, mountain ranges and valleys from which no specimens have ever been obtained and in which no examination has been made of the flora. In fact, this applies to the greater part of southern Mexico not directly accessible from the railways and stage lines. It would be safe to say that not more than one-tenth of the main topographical regions of southern Mexico have been explored by the botanist. Some of this territory might be reached from haciendas, but the greater part may be investigated thoroughly and profitably only by means of a small independent expedition carrying its own outfit and supplies, as most of the country has nothing beyond the resources of scattered Indian villages in which the traveller is apt to meet with little beyond "no hay" and the tardy service of a people living in the very home and seat of the spirit of "mañana."

Respectfully,

D. T. MacDougal.

THE RAPID GROWTH OF THE YOUNG PAULOWNIA.

The tree from which the accompanying illustration was made was purchased early in May, 1905, and placed in its present position near the drinking fountain but a short distance southeast of the Museum. It was a rather sorry looking object upon its arrival, and at that time did not appear to have before it a long and prosperous career, but appearances are often deceptive, as the sequel here will show. The tree was planted and the first year made two new shoots from the roots, one of which was removed. The wonderful growth of this one shoot during the past summer shows clearly that it is not always safe to venture an opinion as to what a young tree may do, even though it

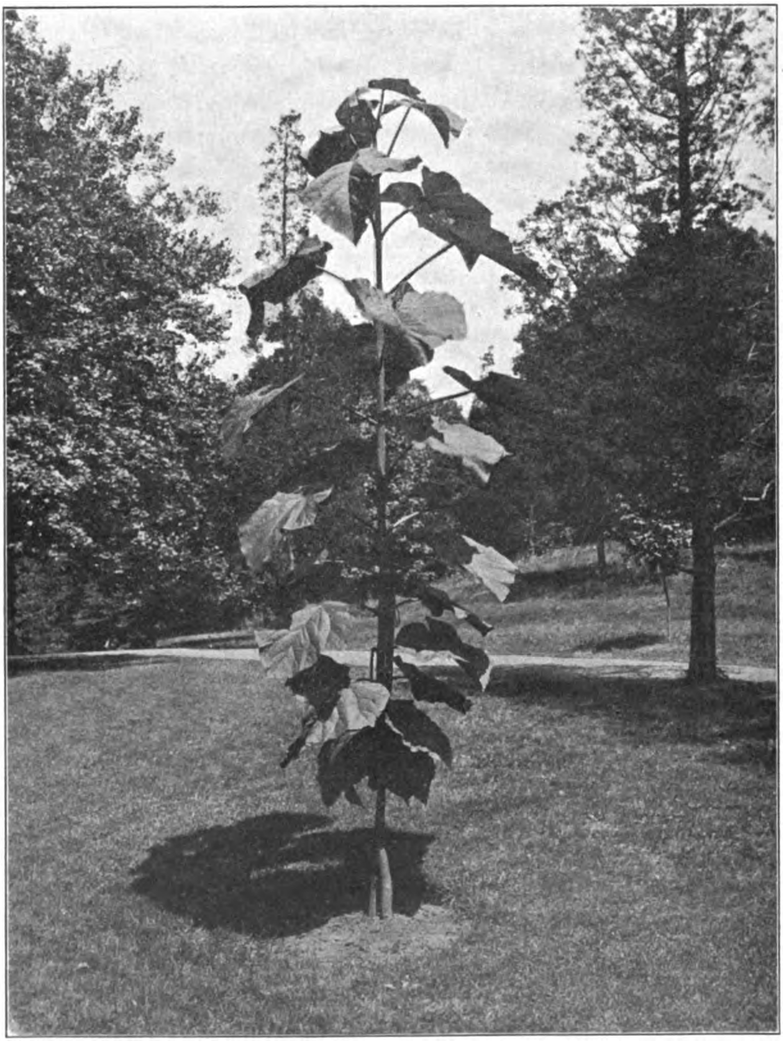

FIG. 8. A young Paulownia tree (*Paulownia tomentosa*).

appear a weakling, for it may have wonderful recuperative powers. The shoot, when spring opened up last year, measured two feet six inches in height, and at the end of the growing season the stem had attained a stature of sixteen feet six inches, a gain of fourteen feet in one season's growth. As indicated in the illustration, its leaves are large and showy, giving quite a tropical aspect to the plant, which has attracted considerable attention from visitors to the Garden. This tree is known to botanists as *Paulownia tomentosa*, or sometimes as *Paulownia imperialis*.

Its rapid growth and magnificent foliage when young are not the only attractive features of this species. As it matures it spreads out into a shapely tree with widely spreading branches, bearing leaves much resembling those of the catalpa or Indian bean. During the late summer and fall the flower clusters are formed. Their growth does not proceed beyond the bud stage, however, and they remain in this condition during the winter, the tree at that time presenting an odd appearance with its two kinds of inflorescences, those bearing the brown woolly flower buds, and those with the much larger capsules which are pointed and black and remain attached to the tree for a long time. About April or May the flower buds expand, before the leaves are fully out, and a full-grown tree at such times is a delight to the eye, with its rich mantle of scented flowers borne in great profusion in large clusters. The flowers are purple and resemble those of the common foxglove in color and form. A fine specimen of this tree is located near the Lorillard mansion in Bronx Park. It is many years old and perhaps has not many more to live, but it is still vigorous enough to put forth a wealth of flowers nearly every year.

This tree is a native of Japan, where it is known as Kiri or Tô. It attains there a height of thirty to forty feet and a trunk diameter of two to three feet. It is found most commonly in the southern parts of the country, thriving in the valleys, especially in those exposed to the hot sun. It was originally described by Thunberg as a *Bignonia*, under the name of *Bignonia tomentosa*, and it was not until some years later that Siebold and Zuccarini recognized it as the type of an undescribed genus, to which they gave the name of Paulownia, in honor of Anna

Paulowna, a hereditary princess of the Netherlands. It was introduced into cultivation in Europe by Siebold, and seems to have flowered in England for the first time out of doors about 1852. It is a member of the figwort family, to which belong also the foxglove, the mulleins, the speedwells or veronicas, the beard-tongues or pentstemons, and many others of our well-known plants.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT.

Dr. M. T. Cook has been awarded a research scholarship at the Garden for 3 months, beginning January 1.

Professor J. C. Arthur and Mr. F. D. Kern, both of Purdue University, Lafayette, Indiana, are continuing their researches on plant rusts in the Garden herbarium during the month of January, and completing their monograph of these minute destructive fungi for publication in "North American Flora," part of it being already in press.

The Botanical Society of America met at the Garden on December 29. The programme, including the address of the retiring president, was completed by 1.30 P. M. Over a hundred persons remained to luncheon.

The lichen collection of Dr. H. E. Hasse, of California, consisting of about 3,000 species and many duplicates, has been recently presented to the Garden by Mr. John I. Kane. Most of the specimens are from America, many of them having been collected by Dr. Hasse in California, while a goodly number of European specimens are scattered through the collection.

Mr. Guy West Wilson, one of the student guides at the Garden, presented an interesting paper on the "Downy Mildews" at the meeting of the botanical convention, December 5. The members of this class are filamentose alga-like fungi which are either aquatic or aerial. The aquatic forms, of which *Saprolegnia* is an example, are parasitic on fishes and other animals. The aerial members of the class are parasitic upon green plants.

These are divided into two families upon the basis of habit of growth and method of germination. The first, Albuginaceae, contains a single genus, *Albugo*, the species of which are known as white rusts. This genus numbers about fifteen species, seven of which are North American. Of the latter all but one are of economic importance. The second family, Peronosporaceae, known as the downy mildews, contains seven genera with about one hundred and ten species, sixty of which are North American and many of which are of economic importance.

Miss Gertrude S. Burlingham has been conducting some experiments at the Garden to determine the effect of magnesium salts upon plant growth. Magnesium salts in the absence of calcium salts are generally considered to be toxic to plants. Dr. Loew makes the statement that "Plants succumb soon when placed in diluted solutions of magnesium salts and no other. In fact magnesium salts can exercise their nutritive functions only in the presence of a sufficient amount of calcium salts." With the view that the inhibitory effects noted by Loew might have been due to the use of excessive amounts of magnesium, experiments were undertaken to determine the effects of magnesium sulphate in dilute solutions, using the water culture method. Seedlings of abutilon, pea and corn about 3 cm. long were used. They were suspended over the mouth of beakers either through holes in paraffined cork, or from glass rods. Growth was measured for the first 168 hours. The magnesium sulphate solutions were made up with distilled water and chemically tested Kahlbaum salts. In each series seedlings were grown in distilled water as a control. From the results obtained these conclusions are drawn: that as with calcium, so with magnesium, there is a dilution in which the toxic action is lost and stimulation begins, this dilution varying with the type of seedling; that from this point there is a gradual increase in stimulation with each successive dilution until a maximum is reached beyond which the growth decreases to the control; and that the vitality of seedlings grown in proper dilutions of magnesium sulphate is greater than in seedlings grown in distilled water.

Two notable contributions to fossil botany by Dr. Arthur

Hollick have been issued during the past month by the United States Geological Survey and by the Maryland Geological Survey. The first * represents the results of about fifteen years of field work and critical examination of material collected by the author and others on Staten Island, Long Island, Block Island, Martha's Vineyard, Nantucket, the Elizabeth Islands and Cape Cod. A large part of this material, including many of the type specimens, is the property of the Garden, and the remainder belongs to either the Staten Island Association of Arts and Sciences, the Long Island Historical Society or the United States National Museum. The work was undertaken at the suggestion of the United States Geological Survey in order to solve, if possible, several perplexing problems in the geology of the region by means of the evidence afforded by fossil plants, and the results attained in this connection are condensed on p. 29 in a correlation table of the insular and allied formations. The total number of species described is 222, including 31 which are new to science. The ferns and fern-allies number 6, the conifers 27 and the angiosperms 189.

In the second of these contributions, † Dr. Hollick has written the part on fossil plants, in which some 40 species are described and figured, including 11 new to science. Under agreement with the Maryland Geological Survey a free set of the specimens upon which this part of the work was based will become the property of the Garden. It is by far the most extensive contribution to the palaeobotany of the Pleistocene formations which has been published in America and the material represents a collection which is not duplicated elsewhere in this country.

The total precipitation at the Garden during the month of December, 1906, was 2.36 inches. The following maximum tem-

* "The Cretaceous Flora of Southern New York and New England." | By Arthur Hollick. | Monographs of the U. S. Geol. Survey, Vol. L. | 4to, cloth, pp. 217, pls. i–xl. | Washington, Govt. Printing Office, 1906.

† "Systematic Paleontology of the Pleistocene Deposits of Maryland." | By Wm. Bullock Clark, Frederick A. Lucas, O. P. Hay, E. H. Sellards, E. O. Ulrich and Arthur Hollick. | Pliocene and Pleistocene Rept., | pp. 153–281, pls. xxxiv–lxxv. | Maryland Geol. Survey, Johns Hopkins Press, Baltimore, December, 1906.

peratures were registered: 55° on the 6th, 55° on the 15th, 46.5° on the 21st, and 42° on the 29th. The minimum temperatures during the same period were: 9° on the 4th, 14° on the 12th, 9° on the 19th, and 12° on the 24th.

ACCESSIONS.

PICTURE COLLECTION.

1 photograph of Professor T. C. Frye. (Given by Mrs. N. L. Britton.)

1 photograph of group of botanists at Vienna, June, 1905. (Given by Mrs. N. L. Britton.)

1 photograph of the original Concord Grape vine. (Given by Dr. L. M. Underwood.)

30 plates from various sources.

12 photographs of scenery and buildings in the New York Botanical Garden.

3 photographs of Professor Hugo de Vries' Garden at Amsterdam. (Given by Dr. D. T. MacDougal).

2 photographs of portrait of Governor Cadwallader Colden. (Given by Miss A. M. Vail.)

1 photograph of Arbor Vitae at Natural Bridge, Virginia. (Given by Miss A. M. Vail.)

1 photograph of Botanical Garden at Brussels. (Given by Miss A. M. Vail.)

2 photographs of Idaho scenery. (Given by Miss A. M. Vail.)

MUSEUM AND HERBARIUM.

28 specimens of North American Ustilaginales. (Given by Mr. G. P. Clinton.)

21 specimens of *Oxalis* from Mexico. (By exchange with the U. S. National Museum.)

4 specimens of mosses from New Hampshire. (By exchange with Miss Annie Lorenz.)

10 specimens of mosses from Nova Scotia. (Collected by Dr. C. B. Robinson.)

13 museum specimens of *Caulerpa* from Ceylon. (By exchange with Dr. Nils Svedelius.)

200 specimens of fungi from the western United States. (By exchange with the Missouri Botanical Garden.)

1 specimen of fungus from Washington, D. C. (Given by Mr. P. L. Ricker.)

6 specimens of fungi from Nova Scotia. (Collected by Dr. C. B. Robinson.)

50 specimens of fungi from England. (Collected by Mr. C. E. Hartley-Smith.)

1 specimen of fungus from Georgetown, Conn. (Given by Professor L. M. Underwood.)

176 specimens of North American plants. (By exchange with the Herbarium of Harvard University.)

8 specimens of Swedish plants. (Given by Dr. Nils Svedelius.)

172 specimens from California. (Collected by Mr. A. A. Heller.)

3 specimens from Nova Scotia. (Collected by Mr. C. L. Moore.)

87 ferns from Cuba and the Isle of Pines. (By exchange with the U. S. National Museum.)

30 specimens "Musci Acrocarpi Boreali-Americani" (Distributed by Professor John M. Holzinger.)

224 specimens from Guatemala. (Collected by Mr. Charles C. Deam.)

30 specimens of fungi from California. (By exchange with Mr. S. C. Edwards.)

17 specimens of fungi from Grenada, W. I. (Collected by Mr. W. E. Broadway.)

1 specimen of *Physcomitrium Kellermani* from North Dakota. (Given by Dr. J. F. Brenckle.)

23 mosses from Alabama. (By exchange with the Geological Survey of Alabama.)

97 specimens from British America. (By exchange with the Geological Survey of Canada.)

1 specimen of *Catharinea crispa*. (By exchange with Miss Annie Lorenz.)

7 specimens of fossil plants from North America. (By exchange with Professor D. S. Martin.)

32 specimens of hepatics from New Zealand. (By exchange with Mr. T. W. Naylor Beckett.)

1 specimen of oak gall from New Jersey. (Given by Mrs. W. A. Lyall.)

3 specimens of conifers from North America. (By exchange with the U. S. National Museum.)

2 specimens of *Juniperus Knightii* from Wyoming. (Given by Professor A. Nelson.)

100 specimens of wild vegetable foods of North America. (Given by Dr. H. H. Rusby.)

5 specimens of blackberries. (Collected by Dr. P. A. Rydberg.)

1 specimen of roots of *Brauneria angustifolia*. (Given by Messrs. Peck and Velsor.)

15 specimens from Michigan. (Given by Dr. H. H. Rusby.)

400 specimens from the Barbados. (By exchange with the Department of Agriculture, Barbados, W. I.)

900 specimens from Jamaica. (Collected by Mr. William Harris.)

184 specimens from Washington. (Collected by Mr. Carl C. Engberg.)

1 specimen of *Pinus strobiformis*. (By exchange with the Forest Service.)

150 specimens from Indiana. (By exchange with Mr. Charles C. Deam.)

3 specimens of conifers from California. (By exchange with the Forest Service.)

6,000 specimens from Porto Rico. (Collected by Dr. N. L. Britton and others.)

57 specimens from British America. (By exchange with the Geological Survey of Canada.)

1 specimen of plant impressions in calcareous tufa. (Given by Mr. Guy W. Wilson.)

500 specimens from Nova Scotia. (Collected by Dr. C. B. Robinson.)

2,400 specimens from Costa Rica. (Collected by Mr. Wm. R. Maxon.)

700 specimens from Cuba. (Collected by Mr. Norman Taylor.)

33 specimens from Colorado. (By exchange with Mr. George E. Osterhout.)

8 mosses from Rarotonga, Cook Islands. (By exchange with Mr. T. W. Naylor Beckett.)

69 specimens from Utah. (Given by Professor A. O. Garrett.)

1 specimen of *Cuscuta* from Georgia. (Given by Dr. R. M. Harper.)

2,000 specimens from subtropical Florida. (Collected by Dr. John K. Small and Mr. J. J. Carter.)

39 specimens of fungi from Nova Scotia. (By exchange with Dr. A. H. Mackay.)

1 specimen of *Andreaea rupestris* from Massachusetts. (Given by Miss Cora H. Clarke.)

5,000 specimens from Jamaica. (Collected by Dr. N. L. Britton and others.)

100 specimens, "Fungi Columbiani" Century XXIII. (Distributed by Mr. E. Bartholomew.)

92 specimens from Mexico. (By exchange with the U. S. National Museum.)

279 specimens from California and Lower California. (Distributed by Mr. A. A. Heller.)

318 specimens from the Philippine Islands. (Collected by Mr. A. D. E. Elmer.)

2 specimens of orchids from New England. (Given by Miss A. M. Vail.)

50,000 specimens of mosses, being the herbarium of the late Mr. William Mitten.

15 specimens of fungi from New York. (Collected by Dr. W. A. Murrill.)

2 specimens of fungi from Oneida, New York. (Given by Mr. William R. Maxon.)

10 specimens of fungi from Brazil. (Given by Mr. G. Bresadola.)

83 specimens of marine algae from New Zealand. (Collected by Mr. R. M. Laing.)

1 specimen from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

4 specimens of fungi from Alabama. (Given by Dr. R. M. Harper.)

50 specimens of fungi from New Hampshire. (Collected by Mr. P. Wilson.)

100 specimens of fungi from British Honduras. (Collected by Mr. Morton E. Peck.)

6 specimens of fungi from Europe. (Given by Mr. L. Romell.)

1 fungus from South Carolina. (Given by Mr. E. W. Berry.)

5 specimens of fungi from New York. (Collected by Mr. G. W. Wilson.)

PLANTS AND SEEDS.

2 plants for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

1 plant for the conservatories, from Cienfuegos, Cuba. (By exchange with Mr. F. Weinberg.)

2 plants for the conservatories. (By exchange with the N. Y. Zoölogical Garden.)

2 plants for the conservatories. (By exchange with Mr. F. Weinberg.)

389 woody plants for the borders. (Purchased.)

214 plants derived from seeds from various sources.

16 packets of seeds. (Given by Mr. C. Wercklé.)

2 packets of seeds. (By exchange with Bureau of Plant Industry.)

1 packet of seeds. (By exchange with Prof. T. D. A. Cockerell.)

1 packet of seeds. (By exchange with Royal Gardens, Kew.)

1 packet of seeds from Oklahoma. (By exchange with Dr. J. C. Arthur.)

1 packet of seeds from Jamaica. (By exchange with the Public Gardens.)

1 packet of seeds from Cuba. (Collected by Mr. N. Taylor.)

2 packets of seeds from Nova Scotia. (Collected by Dr. C. B. Robinson.)

2 packets of seeds from Pennsylvania. (Collected by Dr. J. A. Shafer.)

34 packets of seeds from the Arnold Arboretum. (Collected by Mr. W. W. Eggleston.)

3 packets from Bartram's Garden. (Collected by Mr. W. W. Eggleston.)

2 packets of seeds from Philadelphia. (Collected by Mr. W. W. Eggleston.)

1 packet of seeds. (Collected by Mr. A. Miller.)

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EXPLORATION OF SOUTHERN FLORIDA.

Dr. N. L. Britton, Director-in-Chief.

Sir: In a former report on an expedition to Southern Florida,* I called attention to the fact that it had been our good fortune to explore some of the islands lying in the everglades southwest of Miami while they were yet uninhabited. During our recent expedition to the same region, the value of our earlier explorations was emphasized by what we saw of the destruction caused by the hurricane that had recently swept south Florida. Had we not acquired a fundamental knowledge of the native vegetation of that unique and fascinating region as early as we did, our knowledge of the relation of the flora of south Florida to that of tropical America would have remained very imperfect.

With your permission I left New York on the twenty-second of last October, and proceeded direct to Miami, Florida. I was joined on the way by Mr. J. J. Carter, of Pleasant Grove, Pennsylvania, who continued my tireless associate throughout the expedition. Upon the invitation of Dr. Ernst A. Bessey, who is in charge of the Subtropical Laboratory of the United States Department of Agriculture, we established our headquarters in the laboratory building of that institution, and to Dr. Bessey and his associates, Mr. Fawcett and Mr. Wester, we tender thanks for their constant coöperation and association. We were also accompanied during most of the field work by Dr. H. C. Cowles, of the

* Jour. N. Y. Bot. Gard. 5: 49. 1904.

University of Chicago, who, together with Mrs. Cowles, is studying certain features of the Florida flora.

The object of our field work was mainly two-fold; first, we had planned a survey of Long Key and several adjacent everglade islands which, taken together, form the southwestern extremity of the chain which appears north of the Miami River; second, we had arranged to continue the survey of the Florida Keys, in order to secure and to preserve the knowledge of the native flora of that singular chain of islands before it becomes further obscured or wholly destroyed by the advance of civilization. The high water in the everglades prevented us from getting more than a distant view of Long Key, consequently we continued exploration on the larger group of islands lying between Miami and Camps Longview and Jackson, and through the courtesy of Mr. Johnson, of the Florida East Coast Railway engineer corps, we were enabled to penetrate a wholly unexplored section of the everglades lying between the present terminus of the railway and Key Largo, including a portion of Cross Key. Our interesting experience on the latter island indicated further important discoveries when its flora shall be more thoroughly explored. This island, together with a parallel and almost similar formation, constitutes the only natural and approximately complete land-connection between the Florida Keys and the mainland of the peninsula.

As we reached the field about a week after the occurrence of the hurricane already referred to, we had an opportunity to observe its effects on the vegetation. The everglades were exceptionally full of water, a condition caused not only by the heavy rains of the recent storm, but also by those of a very wet season preceding it. On the islands of coral sand-rock, the pinelands were uninjured except for the relatively insignificant loss of myriads of pine trees which were blown over by the wind, the number being especially large because of the fact that the trees growing directly on the exposed rock cannot make tap-roots. The islands ranging from the vicinity of Homestead Station southward had been completely submerged during the latter stage of the hurricane; the water lying to the northwest being pushed out of the everglades by the extremely high winds, swept over the islands, and poured into the everglades to the southeast. The hammocks were greatly injured, the very small ones isolated in the higher portions of the pinelands being especially damaged. With only the slight external protection of the slender pine trees to break the force of the wind, their vegetation was practically mowed down.

These little hammocks were the homes of many of the botanical treasures of the region. Within them were formerly discovered numbers of West Indian plants not known to occur elsewhere on the North American mainland. The half dozen of these hammocks which we examined critically during this last expedition were found to be almost total wrecks. Their complete natural restoration will be a question of at least a century, if the homesteader does not finish the destruction already accomplished by the wind. Formerly, the spreading tops of the tall trees, whose trunks varied from two to four feet or more in diameter, interlaced with one another, and the branches were further bound together by means of numerous herbaceous and woody vines. The direct sunlight was thus wholly excluded from the inside of the hammocks, and no matter at what angle the sun might be, twilight reigned there from sunrise to sunset. Many species of plants, both flowering and flowerless, that could not even exist elsewhere in the vicinity, were found to thrive there luxuriantly.

In the case of the Florida Keys, some of the upper islands were twice completely submerged during the hurricane, first by the water blown in from the ocean while the wind came from the southeast, and then by the water blown out from the bay when the wind came from the northwest. Elliott's Key was a conspicuous example of devastation. Under normal conditions the vegetation of this key is luxuriant, both the herbaceous and woody plants growing in such masses as to be almost impenetrable at most places, and, as seen from the bay or from the ocean, exhibiting a solid bank of green. During our last visit this key presented the aspect of a desert; the herbaceous vegetation and small shrubbery was temporarily almost annihilated by the deluge of salt water, while the trees and shrubs presented leafless and apparently dead skeletons, the wind having whipped off every leaf. Several weeks after the storm all of the trees, as if recovering from the shock, started simultaneously to put forth not only new leaves, but also flowers.

Our investigations on the keys were confined to the northern ones, and we have learned that on account of their floras, as well as their position, Virginia Key and Key Biscayne, which lie opposite Miami and Cocoanut Grove, are to be associated with the mainland, which ends as a narrow peninsula just north of them, and not with the rest of the keys; from which, moreover, they are separated by an interval of almost ten miles, leaving out of consideration the insignificant Soldier's Key, which is a mere isolated sand-bar about five miles south of Cape Florida. Their vegetation consists of a dense growth of mangrove on the side facing the bay, the usual tropical beach flora along the ocean and a few of the sand-dune plants which are common for many miles northward along the coast.

Our work on the mainland was considerably impeded by the effects of the hurricane, the high water in the everglades, which in some sections partially submerged the islands and filled all of the prairies, and the fallen trees throughout the pinelands greatly delayed our progress. We experienced the most difficulty in making progress to the southwest of the settlement of Cutler, where time was consumed in mending both harness and wagon. Naturally, accidents happened in the more unfavorable places. At one point in the everglades, when the doubletree and one singletree of the wagon and three traces and several minor straps of the harness all broke simultaneously, the driver, before he recovered from the shock, had the charity to suggest that he ride the horses to the nearest point of dry land and that the rest of us pull the wagon out. Contrary to the exhilarating effect which the environment of these rugged and uninhabited regions had on most of us, it seemed to have a uniformly depressing effect on our drivers. This was most plainly shown by the fact that we had a new driver on each successive excursion. The monotony of wading the submerged prairies, which are usually dry at that season, was varied by both the depth of the soft mud and the number of the treacherous pot-holes in the rock bottom under the mud. In fact, we became so accustomed to an amphibious mode of life that several of the party complained that they did not feel natural when deprived of the aquatic stage for any length of time.

We have now accumulated enough knowledge of the flora of these islands of coral sand-rock in the everglades to make the solution of many problems, both general and local, very interesting. This chain of everglade keys is a miniature of the Florida Keys, both in its crescent shape and its flora, and also of the West Indies in the character of its vegetation. It is surrounded by the everglades, except where the upper islands touch Biscayne Bay at points from Miami to Cutler. Before these islands were elevated to their present altitude, they were probably surrounded by a shallow sea just as the Florida Keys are at the present time. This being the case, we can easily account for the tropical American flora now inhabiting them. After sufficient elevation had taken place, the surrounding sea was transformed into the vast spring now known as the everglades. Conditions becoming favorable, the plants of the flora of northern peninsular Florida advanced southward and naturally took complete possession of the area that was formerly the sea, thus surrounding and isolating the wholly different flora of the islands. In fact, the two floras are so sharply delimited that one can often stand with one foot on plants characteristic of the high northern regions and the other on plants restricted to the tropics. It is not an uncommon experience to see colonies of plants common in Canada, such as the arrowarum (*Peltandra*), the lizard's tail (*Saururus*) and the ground-nut (*Apios*), growing side by side with tropical palms, cycads, orchids and bromeliads.

The total area of these islands is perhaps about one hundred and fifty square miles. Those that we have explored have yielded between five and six hundred species of native flowering plants, surely a very large number when we consider that the solid rock is exposed everywhere and that soil in the sense that we are accustomed to think of it does not occur there. The close relationship of this flora to that of the West Indies is now established by the fact that considerably more than one half of the species found on the islands south of Miami are also native in Cuba and the Bahamas.

Since the publication of my last report on exploration in southern Florida,* and a subsequently printed paper on the species added to the flora of that state,† we have secured over fifty more species not before known to grow on the North American mainland. Eight or ten of these are complete novelties, inasmuch as they are not yet described. Noteworthy among the recent collections, which make an aggregate of 3,200 specimens, are seven species not previously included in the arborescent flora of the United States.

Respectfully submitted,

J. K. SMALL,

Head Curator of the Museums and Herbarium.

THE MITTEN COLLECTION OF MOSSES AND HEPATICS.

William Mitten died at Hurstpierpoint, Sussex, England, on July 20, 1906. Following his last request, his daughter, Miss Flora Mitten, offered his entire collection of mosses and hepatics to Mrs. N. L. Britton and the collection was purchased for the New York Botanical Garden for £400, the donors being Messrs. D. O. Mills, Andrew Carnegie, J. Pierpont Morgan, Jas. B. Ford, Geo. W. Perkins and Charles F. Cox.

At the request of Dr. Alfred Russell Wallace, Mr. Mitten's executor, a representative of the Garden, Mr. R. S. Williams, was sent to pack and ship the collection, which was received safe and in good condition on December 6, 1906. Besides twenty large boxes full of mosses, the collection contains ten boxes of hepatics. Mrs. Britton also received as a gift from Miss Mitten a large photograph of her father and his personal copy of the "Musci Austro-Americani," his greatest work, which, strange to say, is absolutely without notes or writing of any kind, as Mr. Mitten was in the habit of laying memoranda and descriptions of subsequent additions in the covers with his specimens.

* Jour. N. Y. Bot. Gard. 5: 157–164. 1904.
† Bull. N. Y. Bot. Gard. 3: 419–440. 1904.

Two accounts of Mr. Mitten's life and work have appeared, one in the Journal of Botany for October, 1906, by W. Botting Hemsley and the other in the Bryologist for January, 1907, by William Edward Nicholson, both of which are interesting personal sketches, the latter giving a bibliographical list, but neither of them containing any account of his collections. In a letter dated September 5, 1906, Dr. Wallace states that "Nobody ever touched, or hardly ever saw these collections but Mr. Mitten himself and a few specialist visitors. Although I have never examined them myself, as a friend (and a son-in-law) of Mr. Mitten for forty years, I know something of them and I am inclined to think that they constitute the richest (or nearly the richest) private collection of those groups in existence, while it is doubtful if any public collections are much richer. Mr. Mitten, as you know, has studied and described mosses for nearly sixty years, and for a long time was the greatest British authority on them, and received collections to sort, name, and describe from collectors, museums, and travelers, in every part of the world. Of all these he reserved sets for himself, and has thus accumulated an enormous collection, the nomenclature and arrangement of which he was at work at up to the end of his life."

Beginning in 1851 with a list of mosses and hepatics from the vicinity of his home in Sussex, the 57 titles which follow include studies of the mosses and hepatics from Quito, Portugal, New Zealand, Panama, the East Indies, Tasmania, Fiji, Tropical Africa, the Azores, Japan and China, Samoa, Ceylon, St. Paul, and St. Helena, Bermuda, Kerguelen, Cape of Good Hope, Morocco, Polynesia, British Guiana, Socotra and Borneo.

His largest and chief work was the description of the mosses of South America, including Central American and West Indian species. This was published as Vol. 12 of the Journal of the Linnean Society in 1869. It contains 659 pages and includes 603 species and 19 genera new to the region, of which the types are in his herbarium. It was largely based on the collections made by Richard Spruce in his travels up the Amazon, Orinoco and Rio Negro and across the Andes, and by Jameson, in Peru; as well as those made by Lindig and Weir in New Granada;

Burchell and Glaziou in Brazil; Funck and Schlim in Venezuela; Martens, Galeotti and Bourgeau in Mexico; Godman and Salvin in Guatemala, and by Seemann in Panama. Collections from the West Indian islands include the following: From Jamaica by Swartz, Purdie, Wilds, Wilson, Hart, Jenman and Harris; from Cuba by Wright; from Grenada by Broadway; from St. Christopher by Breutel; from Trinidad by Fendler and Cruger; and from Haïti and Santo Domingo by Swartz. He had very few mosses from the French Antilles, a lack which has already been supplied in the Garden collections by the purchase of the herbarium of Père Duss, made in the islands of Guadeloupe and Martinique, which contains many species whose type localities have since been destroyed by the volcanic eruption of Mt. Pelée.

His collections are not as rich in European exsiccatae as that of Jaeger, but they supplement those already at the Garden with several sets that were lacking, notably Spruce's Mosses of the Pyrenees. There are also two fine sets of Drummond's First Arctic and Canadian Collections of North American Mosses, secured during the second Land Arctic Expedition under the command of Sir John Franklin, in 1828. One of these sets was the property of Sir John Richardson. He also had a set of Drummond's Second Collection from the Southern States, 1841, one of Sullivant's Musci Alleghanienses, 1845, and one of Sullivant and Lesquereux's Musci Boreali Americani, First Edition, 1856. Besides these he had collections from Richardson made in the Northwest Territory from the vicinity of Great Bear and Great Slave Lake; from Davis Strait and Arctic America by James Taylor; from Lake Winnipeg, Saskatchewan and the Rocky Mountains by Bourgeau in Palliser's British North American Expedition, 1859; and from the Northwest Coast, Vancouver Island and British Columbia by Menzies, Lyall and Douglas. The mosses of the 49th parallel, or the northern boundary of the United States, were named and listed by Mitten, in the Proceedings of the Linnean Society, 1864. From John Macoun, he received a fine set of the mosses of Ontario. He also had specimens sent by Dr. C. W. Short from Kentucky, Chapman from Florida, T. P. James from New Hampshire, and John Torrey rom New York.

Among the most valuable of his collections are those made by the various Arctic and Antarctic Expeditions. Among these are the sets of mosses from Spitzbergen collected by Parry and Ross in 1819–1820, from the herbarium of Robert Brown, and those collected in Greenland, Baffin's Bay and Melville Island by Franklin in his search for the Northwest Passage. There are also collections made by Seemann on the Voyage of H. M. S. Herald in 1845–1851 at Panama, by the Transit of Venus Expedition in 1874–1875, by Moseley on the Voyage of the Challenger in 1875, including specimens from Bermuda, and by the Roraima Expedition in British Guiana in 1884.

Asiatic mosses are represented by collections in the Himalayas by Hooker and Thomson; in Nepal by Griffith; in Ceylon by Thwaites; and in Burma and the Straits Settlements by Griffith. A few Chinese and Japanese mosses also were described in 1864. Those from Borneo, Sumatra and Java, including Fleischer's Musci Archipelagi Indici, will be very useful in naming the recent collections made in the Philippines by Mr. R. S. Williams. The collections from New Zealand made by Hutton and Kirk and from Samoa by Powell seem to be largely duplicated and available for exchanges. Besides these, there are other Polynesian mosses from Fiji and New Caledonia, and Australian mosses from Melbourne, Port Philip, Gippsland, Victoria and New South Wales,

African collections were received from Central Africa, collected by Bishop Hannington and from Kilimanjaro by H. H. Johnston; from West Africa from the Cameroons and River Niger; from Southern Africa, including Rehman's exsiccatae of 1875–1877; from the Cape of Good Hope by Milne and Eaton and McGillivray and Burchell; from Madagascar by Pool; from Mauritius by Ayres, Balfour and Telfair; from Bourbon and Socotra by J. B. Balfour; from St. Thomas by G. Mann; from Algiers and Morocco by Sir John Ball; and from Fernando Po and St. Helena, the Azores, and the Atlantic Islands of Madeira and Canary.

Local mosses from the vicinity of Hurstpierpoint and other parts of Sussex and Kent, which had been made up into sets for exchange, are also well represented; together with several duplicate sets of Drummond's mosses of Scotland and collections of his own from Wales.

The entire collection abounds in beautiful drawings, which usually accompany the specimens. It frequently happens that every species in a cover is illustrated.

NATURE-STUDY AS AN EDUCATION.*

Nature-study has been exploited during the last score of years in this country in various ways. It began here as an off-shoot of the so-called object-lessons introduced by Dr. Sheldon into the Oswego Normal School, and received further stimulus in the Cook County Normal School under Dr. Francis Parker and Mr. W. S. Jackman, who attempted the first formulation of nature-study as a distinct subject, and prepared a text-book of numerous isolated suggestions for the teacher, these suggestions ranging through many subjects and sometimes going far afield. And yet the key-note of the book as stated by the author rings out strong and true: "Let us place the children in the woods and fields that they may study nature at work."

About the same time (1889), Mr. Arthur C. Boyden of the Bridgewater Normal School championed the new idea, began teaching in the state institutes of Massachusetts, and got out a pamphlet on the "Study of Trees in Plymouth County"; one of the first of a long series of fluttering nature-study leaflets by men and women who, knowing much or little or nothing at all about the subject, have found the theme a good one to write upon. At the same time, also, a department of nature-study was organized in the Summer School of Cottage City under the name of elementary science, and in the latter part of the eighties, nature-study under the name of elementary science was receiving consideration in many schools in several states.

From 1890 to 1895, exhibits of nature-work were common in cities, the display at the World's Fair in Chicago being the culmination of this phase of development.

* Read before the convention of the New York Botanical Garden January 23, 1905. Published simultaneously in the Garden JOURNAL and the Nature Study Review.

About ten years after the first introduction of elementary science into the grades, two men came forward to whom children will be grateful for centuries to come. Of all the numerous writers who have considered nature-study from one standpoint or another, the principles set forth by Professor Bailey of Cornell and Professor Hodge of Clark, are as sane and practical as anything yet presented. To little people shivering over their first experience in the clear, cold atmosphere of science, a warmer temperature and more genial atmosphere were eagerly welcomed.

While there is no doubt of the constant advance of nature-study over the country as a whole, yet the gain is not the mushroom growth of the first few years, and this is well. There has been lack of fibro-vascular tissue, and in more than one place nature-study has been dropped after a trial. This has occurred in a few large cities where the problem is most difficult, or where the school-board has failed to recognize the value of nature-study as a means of education, or in some cases where the teaching has been inadequate.

Nature-study, then, has already passed through various phases with us: first came the experiment followed by the exhibition which so inspired the on-lookers that it straightway became a fad; then came the period of reaction and criticism when nature-study became less serious — more of a recreation — and here came the opportunity to run in the unusual, the exceptional, the sensational in nature literature, which is not nature-study at all, though it may be very good literature; and now our leading lights tell us that nature-study is an idea, an atmosphere, an attitude, — in a word, it is spirit. This, then, is the promise of the future, and our prophets prophesy wisely and well. But we cannot hope for any universal fulfillment of the prophesy for several generations to come — not until there has been time to train our teachers, and they in turn have had the opportunity of training the children who are to be the parents of the next generation. In the next generation we may begin to look for parents who will not destroy the attitude, the atmosphere of nature-study, which is an inherent part of the nature of the normal child. He inherits from ancestors remote a primitive love of nature and every natural object. Any child of three years turned loose in a small space out-of-doors where there is good clean dirt with worms in it, and pebbles, where green things are growing, where the chance caterpillar and toad and small snake are free to come and go, has amusement for a summer. Some one has well said:

> "Out-doors, God amused him; in-doors his mother;
> And the finite can never satisfy as the Infinite."

It is only when the child learns from others that he "must not touch the toad or he will get warts," that the harmless garter-snake is a poisonous reptile, that the caterpillar will bite; that his faith in nature is shaken, the nature-study atmosphere darkened, and the nature-study spirit hampered.

Dr. M. T. Cook says that in Cuba he frequently gave his one-year-old son small snakes to play with, and the child considered them the most interesting kind of a plaything, until at the age of four he began to run with other children. In a short time the boy became afraid of snakes and is still afraid of them. Professor Hooker, of Mt. Holyoke College, had a little visitor whom she found it hard to entertain, so she brought out some snakes which she called her "little friends." The child was delighted, and played with them happily until she heard some one call them snakes, then dropped them in fear and disgust.

A child in the first primary grade of the University School for Girls in Chicago brought a tiny leafless twig to her teacher and asked her to use it for the nature-study lesson. The teacher thought it a rather small affair, but a leaf-bud or two offered suggestion, and the teacher held out for what seemed to her a very creditable length of time and then turned with relief to a gay picture of an oriole on the wall. But the children did not want orioles in pictures on the wall; they wanted a little live twig, and the small girl who had brought it in raised her hand and asked severely, "Why don't you go on with the nature-science?"

That which we are to aim for, then, we have at the very beginning; but by the time that the child goes to school he has lost more or less of it, and it is more difficult to restore it in a soil that has been sterilized than it would be to start anew in fresh soil. Allowing for individual exceptions, I have found it true that interest in nature-study in schools where the subject is not a vital one varies inversely with the age of the children, and that the difficulty in exciting an interest varies directly with the age.

The problem that confronts us is, how shall we recover that which has been lost; how shall we reach the ideal, the pervading atmosphere that colors, the idea that permeates the whole life, the nature-study spirit. Now the child of the graded school has many teachers. It is a chance if he ever has one who really understands and fully comprehends just what Bailey means by atmosphere and attitude and idea and spirit. It is possible that one may be all this and that the school may have the spirit and never know it. I am not sure but this is the essence of the whole thing — the spirit free because unconscious of itself.

At one of the State Summer Schools held in Bennington, Vermont, a young teacher came to me and told me how much she regretted the impossibility of having any nature-study in the little rural school where she taught. "The parents are not willing that the time should be given in school," she said, "the programme is already crowded, we have no money with which to buy books. But," she added, "there is a little brook back of the school house, and the children and I stay out there about all the time at recess and noon and we all go early in the morning before school. We have a series of pools, and in them we have several kinds of fish, and in one pool we have some salamanders, and in another turtles, and in another pollywogs. We feed them and keep the pools in order and the children do have such a good time. Then a little house-wren came into the school house and built her nest on the stove-pipe by the chimney, right in the school room. And the children would keep just as still as possible so as not to disturb her."

This dear girl assured me over and over again with tears in her eyes that she would be so glad to have nature-study in her school, but that it was simply an impossibility! This illustrates how difficult it is for one to grasp the real significance of the study as presented by even so plain and simple and straightforward a speaker as Professor Bailey.

Atmosphere is intangible at best, and not an easy mark for the inexperienced. One may be sure the arrow will hit somewhere, even if sent at random, and many of our public-school teachers have evidently taken refuge in this thought, and the result is random and haphazard.

The result would be the same and perhaps the idea might seem more definite, if, with the idea of attitude as the ultimate goal, we should begin by aiming at some nearer mark. To inspire the boys and girls with a vital rational interest in their immediate natural environment — an interest that shall continually widen with the circles of growing experience and knowledge founded on experience, and so lead to a wider environment — this is concrete and feasible.

In the country, there is such abundance of material that the question is one of choice; in the more cramped conditions of the larger cities, the question of choice is largely eliminated, and here it is necessary to seize upon every natural object that comes within the reach of the children and to widen their pathetically limited environment by constantly reaching out, always from something they have seen or experienced, to the things beyond, and to inspire them with a desire to learn what lies outside the few blocks which immediately surround them. Settlement-workers tell us that most children in the crowded tenement districts seldom go beyond the half-dozen blocks which supply the necessities of life. A little girl of nine years was taken to the country for the first time. She was amazed beyond measure; she had attended the public-schools, but she had never been told that the earth was not paved all over, and it had never occurred to her that it could be any other way. Let us teach the children to love the parks, not simply as pleasant places in which to play but as places where one can know the trees as individuals that in time may become one's comrades and friends. To know the trees that are in our parks, to know them by their outlines and buds and twigs and leaves and flowers and fruits, and to watch the changes in them from week to week and season to season is to have an unfailing resource for pleasure throughout life. To teach the child a proper appreciation of our parks and scenery and to make him feel a sense of ownership in them is to make him some day a better man.

We can do no better and go no farther today than did Aristotle when he said:

"It is clear then that there are branches of education and learning which we must study with a view to the enjoyment of leisure, and these are to be valued for their own sake; whereas those kinds of knowledge which are useful in business are to be deemed necessary, and exist for the sake of other things. It is evident then that there is a sort of education in which parents should train their sons, not as being useful or necessary, but because it is liberal or noble."

In commenting upon this passage, Burnet in "Aristotle on Education" says:

"Here in simple form is the perennial problem as to whether the end of education is culture, or to fit us for the business of life. The most ardent business men will tell you that they work hard in order that they may be able to retire; the misfortune is that when they have retired they are very often at a loss what to do with their time.

"An education which took as its aim to train people in such a way that they could rightly enjoy the rest which they have earned by a life of toil would, we can see, have a good deal to say for itself, and might be quite as "practical" as one which merely anticipated the "useful and necessary" activities of the business life itself. It might sound strange at first, but it would not be amiss if we were once more to speak with Aristotle of the noble enjoyment of leisure as the end of education in its highest sense. It is just the want of such an education that makes men put up with that very poor and cheap substitute for theoria, the life of amusement.

"The Gospel of Work is a noble one and has been nobly preached; but the neglect of the still higher Gospel of Leisure has produced the results which Aristotle has indicated so clearly. We cannot always work, and if our education has not fitted us to use our spare time rightly, we are sure to take to the life of mere amusement. We all know men who would be transformed if only they knew what to do with themselves when they are not at work. We can all see that whole classes of the community are sunk in needless degradation just because their lives are a succession of periods of overwork and intervals of low or vicious relaxation. And we can see too that the end of the nineteenth century, the century of work, has been marked by a morbid, an abnormal growth of the craving for amusement and excitement which has threatened at times to break up society altogether. It is from the Greeks that we can best learn the cause and cure of these ills."

Of the thousands of poor and ignorant people who visit the New York Botanical Garden during the spring and summer and autumn months, on the one day of leisure in the week, one does not dare to venture a guess at the per cent. of those who really care for the things of the park aside from space and coolness. If only these people had been educated to an appreciation of nature, what an additional inspiration this place would become in their sordid lives!

President Cleveland went fishing when the affairs of state became too taxing; President Roosevelt hunts bears. When the little boy in the first grade of to-day becomes president, the same instinctive craving for nature may be satisfied in a simpler way if nature-study be rightly taught. It was not the fish that President Cleveland wanted; he could have bought them with much less trouble at the market. It is not the bear-skins that President Roosevelt wants; he can buy them at the furrier's. What both men want is the free pure air, the untrammeled woods, the sound of rippling water, the call of the thrush, ferns, moss and wild things; in a word, nature. And, after all, fish and bears are only excuses; just the same results could be had by hunting with a camera, or in listing the trees or studying the ecology of a region, or in hunting for rare ferns.

The most serious problem of nature-study just now is the teacher of nature-study. At present she must be born, for she cannot be made, except in a few places. Without question there are some excellent teachers who would never become good teachers of nature-study, no matter what advantages they might receive. But with these rare exceptions, the good teacher would also make a good teacher of nature-study if only she knew her subject. How can she have any adequate comprehension of that which she has not herself experienced? She did not have nature-study in the grades when a child herself; she did not get it in the high school except in rare instances; there are scarcely a score of normal schools that offer nature-study as nature-study; and the number of colleges that offer such courses can be counted on the fingers of one hand. Courses in biology, including botany and zoölogy, are now generally offered in the college, the normal school and the high school; but these courses are largely dominated by the spirit of the scientist and the specialist — and rightfully so.

A little girl said to me: "I don't care at all for botany, but I just love flowers." Now the specialist may love botany and not care for flowers. Particularly if he works along histological or embryological lines, he may be wholly ignorant of nature in any field except the somewhat limited one bounded by the horizon of his microscope. I one day asked a most enthusiastic and successful instructor in one of our leading universities what a certain common wild-flower of that region, new to me, looked like. This man had made something of a specialty of the points brought out in the development of this particular flower and had prepared many slides from it. He replied that he did not know what the flower looked like, and did not care, that that was not the point; that he did not know any flowers by their names in the field, he had no time to learn them, and he did not know what good it would do him if he did know.

A student had just finished her research on a problem connected with pines and had taken her degree. She was out driving with a friend who inquired about some pines they were passing. "Oh, I don't know anything about our native pines, not even their names," was the reply.

Even in the high school the courses in botany and zoölogy have been until quite recently too technical and limited to certain lines to fit the requirements of college entrance. Fitting for college and fitting for life have been two quite different things.

And nature-study should be taught in the grades. Where shall the teacher learn? Can she get it from books? A few summers ago I was riding on the front seat of a trolley car through a beautiful Vermont valley at sunset. A woman whose dress and general air bespoke culture and refinement sat beside me. She was wholly absorbed in the pages of a book and utterly oblivious to the surrounding beauty and glory. I concluded that she was doubtless so familiar with the place that its charms were no longer felt, and I pitied her. We passed a large and stately building on a hillside. "Pardon me," I said, "will you kindly tell me what that building is?" "I'm sure I don't know," was the reply. "I was never here before," and she relapsed into the book again. Then I was seized with curiosity to know what she could be reading. The car gave a favorable lurch, I leaned over, and caught the title of the book, "Self-Culture," and the chapter-heading at the top of the page read "The Love of Nature."

In addition to the quickened and widened environment of the child, which should be the first aim of the teacher of nature-study, we may look with assurance for many valuable results which are by-products. In the past one or another of the by-products has too often been mistaken for the main object. This was especially true at first when it was claimed that the greatest gain to be derived from the study of natural objects is increased power of observation. This increase is a natural result; one looks at the things he is interested in, and the more things one is interested in and the more he is interested in some one thing, the more he sees. "It is active seeing, not passive looking which constitutes observation," says Professor Ganong. The result should culminate in visualization — the power to reproduce subjectively that which has been seen objectively.

The nature-teacher said to the third-grade class of a school in Missouri: "Children, I want you to watch a spider and see if you can learn something about it that you did not know before. Then I would like you to write down whatever you find out and bring it to me." The next day Locke Sawyer brought in the following to his teacher: "Onct I sawn a spider spin his web. He span it on the winder-pain. I watched him as clost as I could. He went along in front and spun behind." Here is the real thing — visualization: one sees the spider with the boy, "going along in front and spinning behind." The delighted teacher, carried away by the enthusiasm of the moment, began to tell the children how spiders spin, how they have a little reservoir of adhesive liquid substance within, which is forced out and hardens into a thread on exposure to the air. Locke was vastly interested; he wanted to write down what the teacher had said, and at his request his paper was returned. This is what he added: "Inside of himself the spider has two tin cans. These are for its web, which is glue before it is spun."

A second scientific value of nature-study is that it develops the power of reason. One learns to generalize from the particular and to make critical comparison. The whole subject of adaptations comes in here and appeals strongly to the child. Bills and beaks and teeth and feet and tails take on new interest when one grasps the fact that they are to serve some special need. Nature-study leads to faith in causality, which involves the belief that every phenomenon is linked with preceding factors. The child is freed from superstition; and bats that cause your hair to fall out, and toads that cause warts, and devil's-darning-needles that sew up your ear if you ever told a lie, lose their terrors and become objects of interest and perhaps companionship.

Of the cultural instincts which are developed, we may note briefly:

1. Power of expression; the child can talk about the thing he is interested in, he can write about it, he can make a picture of it. But let his teacher remember that these are the products of nature-study, and that nature-study can never be the product of talking or writing or drawing. The child's language should be more accurate and logical. He should learn to tell the truth and not exaggerate. Laboratory methods should lead to greater skill and dexterity in the use of the hands.

2. Knowledge for its own sake and love of knowledge should result from the widened environment of the child. Knowing his own surroundings, he is able to interpret what he reads and geography takes on a new meaning.

3. The æsthetic values of nature-study are not to be overlooked in a time when utilitarian ideas are as prominent as today. Let the child know that the sky and clouds and sunset coloring and the river and hills beyond are his in the same sense in which the parks are his — to appreciate and enjoy. Whatever one can see that is beautiful is his own as much as though it were his individual property. All that any one can do with a beautiful object is to contemplate it with appreciation and enjoyment. It is possible for the poorest child to be richer than the multi-millionaire.

4. The industrial and economic side of the question appeals to many, especially to parents and school-boards. Plants and animals beneficial and injurious, pests and their extermination,

problems of food and clothing, of shelter and sanitation and personal hygiene, all become a legitimate part of the great subject.

5. Finally, the ethical value of nature-study which results in happiness to the individual is most important. One is never happier than when riding a hobby and riding hard. Birds or butterflies, trees or mosses, ferns or fungi — it doesn't matter, so long as one has an absorbing interest in the world without. Health and happiness are not to be despised in these days of nerves and constant demands for new sensations.

To the love of all created things nature-study should lead, and if it be true that love is the greatest thing in the world then nature-study is indeed justified. A man who ranks high in the scientific world showed this spirit when he carried a tub of sea-water back to the beach from which it came, a distance of some rods, and poured the water into the sea saying, "I could not see any life there but it would be a pity to run any risk of destroying life needlessly."

That the country-boy will see more of interest and beauty in his surroundings, and that the city-boy will learn greater appreciation of the country may be reasonably expected; but not until the agricultural side of nature-study has been much developed can we hope for that which will help to solve the greater problems of rural districts. Nature-study has no need to demand more than rightfully belongs to her.

MARY PERLE ANDERSON.

NOTES, NEWS AND COMMENT.

Mr. C. F. Millspaugh, of the Field Museum of Natural History, Chicago, spent about two weeks at the Garden before his departure for the Bahamas.

Dr. N. L. Britton and Mrs. Britton left New York on February 11 for the Bahamas, where they will spend several weeks in botanical exploration. Mr. C. F. Millspaugh will join them at Nassau.

Dr. Marshall A. Howe returned on January 30 from an expedition to Jamaica, where he devoted five or six weeks to collecting and studying marine algae in Kingston Harbor and vicinity and at Montego Bay. When the disastrous earthquake of January 14 occurred, he was at Montego Bay, where the shock was comparatively light. His Kingston collections, which were stored at the time in a wooden office building on the water-front of that ill-fated city, were uninjured by the earthquake and escaped the subsequent fire.

In connection with the New York meeting of the American Association for the Advancement of Science, during Convocation Week, 1906–1907, an exhibition was held at the American Museum of Natural History, from December 28 to January 14, by the New York Academy of Sciences. The purpose of the exhibition was to illustrate the most recent advancement in the different branches of science. The Associate Committee for botany consisted of C. Stuart Gager (Charman), George Francis Atkinson, William L. Bray, John Merle Coulter, Margaret Clay Ferguson, Byron David Halsted, Edward Charles Jeffrey, Duncan Starr Johnson, and Lucien M. Underwood. The botanical exhibit, assembled from various institutions and workers throughout the United States, consisted of herbarium, alcoholic, and living specimens, photographs and drawings, microscopic preparations, new apparatus, and literature; representing recent advancement in physiology, morphology, taxonomy, palaeobotany, teratology, pathology, cytology, horticulture, the pedagogy of botany, and the development of botanical gardens and laboratories. There was a total of about forty-five entries, making the botany exhibit the largest, but one, of the exhibition.

Of the precipitation for January, 13½ inches of snow fall were recorded in addition to 1.54 inches of rain. Maximum temperatures were recorded of 58° on the 4th, 67.5° on the 7th, 52.2° on the 20th, and 37° on the 22d. Also minimum temperatures of 27.5° on the 6th, 16.5° on the 10th, 10° on the 17th, 0° on the 24th, and 11° on the 31st.

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MUSEUMS AND HERBARIUM.

287 specimens "Musci Indiae orientalis." (Collected by Mr. W. Gollan.)

3 specimens of fungi from British America. (By exchange with Mr. E. W. D. Holway.)

378 specimens from the Philippine Islands. (Collected by Professor A. D. E. Elmer.)

1 specimen of *Pinus strobiformis.* (By exchange with the Forest Service.)

160 specimens of *Polygonum* from Connecticut. (By exchange with Mr. L. Andrews.)

23 specimens of drug plants. (Collected by Dr. J. A. Shafer.)

160 specimens from British America. (By exchange with the Geological Survey of Canada.)

32 specimens "Hepaticae Indiae orientalis." (Collected by Mr. W. Gollan.)

40 specimens "Lichenes Indiae orientalis." (Collected by Mr. W. Gollan.)

75 specimens of Cuban plants. (By exchange with Estacion Central Agronómica, Cuba.)

5 specimens of hepatics from Rarotonga, Cook Islands. (Collected by Mr. T. F. Cheeseman.)

1 specimen of *Smilax rotundifolia* from Nova Scotia. (Given by Mr. J. E. Barteaux.)

38 specimens of mosses from New Zealand. (Collected by Mr. T. W. Naylor Beckett.)

224 specimens from Guatemala. (Collected by Mr. C. H. Deam.)

125 specimens of fungi from Costa Rica. (Collected by Mr. W. R. Maxon.)

2 specimens of flowering plants from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

1 specimen of *Lobelia* from Maine. (Given by Mr. O. W. Knight.)

PLANTS AND SEEDS.

1 plant for the conservatories. (By exchange with Mrs. B. B. Tuttle.)

3 plants for the conservatories. (By exchange with Mr. M. Richter.)

1 plant for the conservatories. (Given by Mrs. Steele.)

40 plants for the nurseries. (By exchange with the Bureau of Plant Ind.)

44 cuttings for the nurseries. (By exchange with the Bureau of Plant Ind.)

26 plants derived from seeds from various sources.

20 packets of seeds from Western Australia. (Given by Mr. C. S. Thorp.)

1 packet of seeds from Florida. (Given by Dr. J. K. Small.)

1 packet of seeds from Florida. (By exchange with Mr. P. H. Rolfs.)

2 packets of seeds from S. California. (Given by Mr. L. R. Abrams.)

35 packets of seeds from S. California. (Given by Mr. S. B. Parish.)

1 packet of seeds. (By exchange with the Bureau of Plant Industry.)

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REPORT ON A VISIT TO JAMAICA FOR COLLECTING MARINE ALGAE.

Dr. N. L. Britton, Director-in-Chief.

Dear Sir: Pursuant to your instructions, I spent six weeks during December, 1906, and January, 1907, on the island of Jamaica in making collections and field studies of marine algae, and I beg to offer at this time a brief and informal report on the expedition. I left New York December 9 on the *Prinz August Wilhelm* of the Hamburg-American line and reached Kingston the evening of December 14. Through the kind intercession of Mr. William Harris, the superintendent of Public Gardens and Plantations of Jamaica, Mr. David Henderson, one of the leading merchants of the island, very generously placed at my service a workroom in an office-building in a lumber-yard near the water-front of Kingston at the foot of East Street. The first day after the unpacking and settling down was spent in company with Professor Charles Wright Dodge of the University of Rochester in getting acquainted with some of the peculiarities of Kingston Harbor, the "Palisadoes," and the outlying islands or "cays," under the able tutelage of a resident naturalist, Mr. P. W. Jarvis of the Colonial Bank. In conditions like those found in Kingston Harbor and vicinity, very little in the way of marine collecting is possible without using a boat, so I engaged by the week the services of two negro boatmen, with their dug-out canoe *, in which sails could be raised when the breezes favored.

* Made from the trunk of the "cotton-tree," *Ceiba pentandra*.

Kingston Harbor is nearly enclosed by a low narrow tongue of land about eight miles long known as the "Palisadoes." The bottom of the harbor is for the most part muddy, and wide stretches of it are covered with "eel-grass" or "turtle-grass"— *Thalassia testudinum.* In the Bahama Islands, Bermuda, the Florida Keys, and Porto Rico, the *Thalassia* is often accompanied by interesting marine algae of such genera as *Penicillus, Rhipocephalus, Halimeda, Udotea,* and *Caulerpa,* and its leaves often bear a variety of algal epiphytes, but in Kingston Harbor, at least at the time

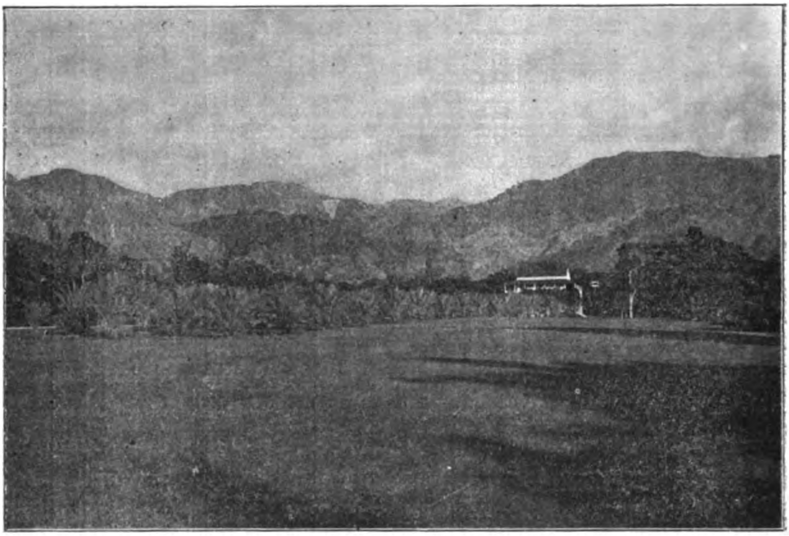

FIG. 9. Hope Gardens, Kingston, showing herbarium- and office-building young date-palms, etc.

of my visit, this eel-grass seemed to occupy the field to the exclusion of nearly everything else. However, certain kinds of algae were to be found on either shore of the harbor; and on the roots of the mangroves, which were especially abundant near the mouth of the harbor, were collected the species of *Bostrychia, Polysiphonia, Catenella,* etc., which commonly affect such situations throughout the West Indian region. In a little creek connecting two mangrove-fringed lagoons were found a few specimens of the rare and interesting *Acicularia Schenckii,* occurring in surroundings very similar to those in which I found it some years ago in Bermuda.* On the long outer beach of the Palisadoes—the low, brush-grown, cactus-covered reef and sandbar which forms the harbor's seawall — several rather uncommon deep-water seaweeds, such as *Dictyurus* and *Haloplegma*, were picked up in considerable quantity. But the low islands and scarcely covered reefs lying in the open Caribbean from one to five or six miles outside the harbor afford the most interesting collecting grounds for marine algae in the Kingston region. Of special interest among the algae found on these cays may be mentioned the forms of the lime-coated Galaxauras, several species of the unjointed corallines — a group which had previously been little collected in Jamaica—, and the very luxuriant display of *Caulerpa clavifera* and of the related but evidently quite distinct *Caulerpa racemosa* (*C. uvifera*). *Caulerpa clavifera* formed extensive handsome mats on coral reefs mostly from the low-water line down to a depth of only one or two feet; *C. racemosa* grew in slightly deeper water and in somewhat more protected places, yet the two were often found intermingled and retaining their distinctive characters perfectly. I had noted the association and distinctness of these two species (*forms* or *varieties* of various authors) on several other of the West Indian islands, but nowhere else have I observed the two in such luxuriance and perfection of development. It may be remarked here that the tides at Kingston are so light (usually with a range of one foot or less) that they can be ignored in the practical work of collecting. A smooth sea, especially if one is to reach the outside cays in a dug-out canoe, is of much greater importance than a low tide. In December, at least, on the south shore of Jamaica the sea is commonly calm during the morning hours and indeed up to eleven or twelve o'clock, by which time the daily breeze has made its surface more or less rough. I therefore planned to make my collections in the morning and forenoon and to arrange and prepare the specimens in the afternoon. On only two or three days of my nearly three weeks' stay in Kingston was the sea sufficiently boisterous to make venturing outside the Palisadoes in a

* See Bull. Torrey Club 28: 323. 1901.

canoe unsafe. And there was not a drop of rain during this period (nor for some weeks before and after) at Kingston. The bright warm sunshine made the possible discomforts of sea-wet clothing scarcely noticeable.

On January 3, I went by rail to Montego Bay on the north-west coast of the island, a distance of 114 miles, as the cars run, from Kingston. Here ten days were devoted to the collection of marine algae, with good results, a considerable number of species occurring here that were not met with on the south shore. The Bogue Islands, in the southern part of Montego Bay, with their

FIG. 10. Montego Bay, Jamaica.

outlying shoals and reefs, formed an especially good collecting ground, and reefs to the north and east of the town also proved to be of much interest. With the aid of a carriage I was able to explore the coast more or less thoroughly for a distance of fourteen miles to the westward of the town of Montego Bay and for eleven miles to the eastward. Except among the Bogue Islands the sea roughened earlier in the forenoon and was in general less easily workable than in the vicinity of Kingston. On arriving in

Jamaica, I had engaged return passage on the *Prinz August Wilhelm*, scheduled to leave Kingston the twenty-fourth of January. It was my plan after finishing the work at Montego Bay to spend a few days in collecting at Port Antonio and then make a brief visit to Cinchona, the tropical station of the New York Botanical Garden, in the famous Blue Mountains of Jamaica. But something happened which had not entered into human calculations. At about 3:35 o'clock on Monday afternoon, the fourteenth, while I was picking up my specimens and collecting outfit for moving on

FIG. 11. The Bogue Islands ("pseudo-atolls"), Montego Bay.

to Port Antonio, occurred the great earthquake which made itself felt throughout the island and brought ruin to its metropolis, Kingston. Little damage was done at Montego Bay, but the few, brief, and conflicting telegrams which reached us that evening and the following day told us plainly enough that a great disaster had overtaken certain other parts of the island. The next day I was on the point of going on board one of the United Fruit Company's banana-laden steamers bound for Port Antonio, as I had previously planned, but was finally dissuaded by the company's local agent, who told me that the hotels in Port Antonio were reported to have been destroyed by the earthquake, that it was accordingly a poor place for one requiring board and lodging to go to, and that I would better remain where I knew I had a good roof over my head! When it was too late for my purpose we learned that this story about Port Antonio was false or at least enormously exaggerated, but, at the time, coupled with the reports that were coming from Kingston, it seemed plausible enough. Wednesday, the coast-wise steamer *Arno* of the Royal Mail line was due, going towards Port Antonio, and I decided to take passage on that. But the *Arno* came neither that day nor

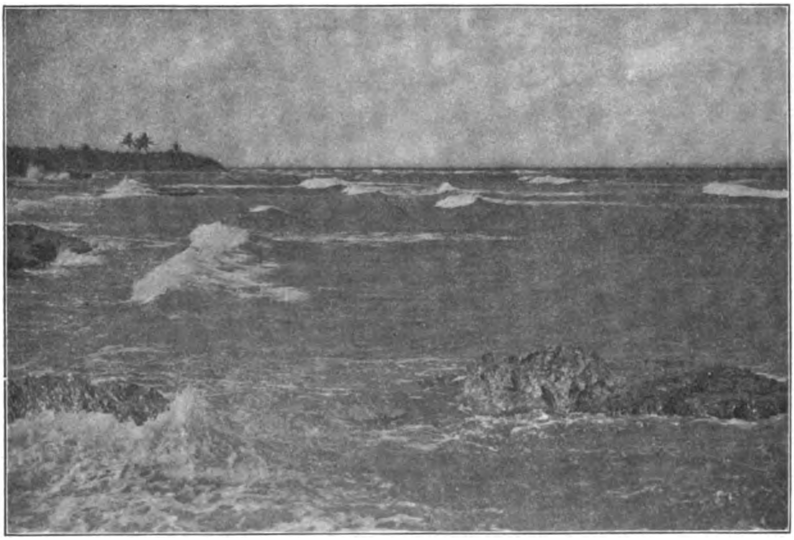

FIG. 12. Shore scene on northern coast of Jamaica, near Montego Bay.

the next and it was announced that her captain had been killed in Kingston (which proved to be true) and that whether the *Arno* would come or not was quite unknown. Meanwhile my goods had remained packed awaiting developments, though it may be said that heavy rains in the forenoons and stiff breezes in the afternoons would have interfered seriously with collecting during those days, even had it been attempted. On the following Saturday, however, a fair day's work in collecting about Montego Bay was accomplished. By Thursday the telegraph office was receiving messages for Kingston and I tried to ascertain by telegram how my friends in the Hope Gardens had fared and whether the proposed visit to Cinchona, for which partial arrangements had already been made, was still feasible. This telegram, as I afterwards learned, was delivered the following Saturday evening. The telegraphic reply, to the effect that the friends in the Hope Gardens were uninjured but more or less homeless, and that the

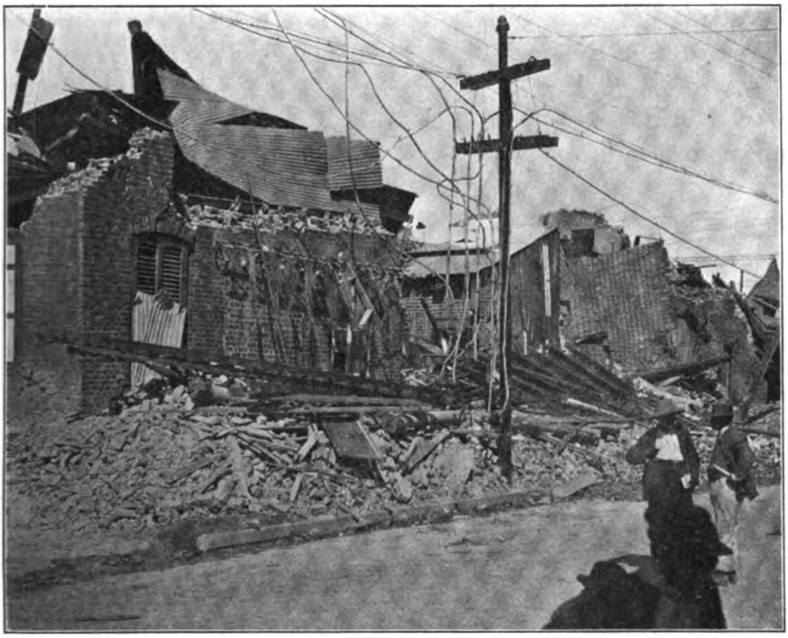

FIG. 13. View near the foot of East Street, Kingston, taken eight days after the earthquake of January 14, 1907, showing effect of the shock alone without fire. (The writer's laboratory was half a block from this, on the opposite side of the street.)

projected trip to Cinchona was no longer to be thought of, I have not received yet. However, on Monday, one week after the memorable fourteenth, I started by rail in the direction of Kingston, going on that day as far as Spanish Town, where the night was spent and whence, with the aid of the next morning's light, I proceeded to reconnoitre the stricken capital of the fair island. The havoc wrought to the second largest city in the West Indies by a few seconds of heaving and trembling of the earth's crust and by the subsequent fires was something fearful and saddening to look upon. The principal business part of the town had been devastated by fire as well as by earthquake, and in the completeness of its ruin was now quite suggestive of an exhumed Pompeii. In the remainder of the city and in the suburban residential areas, about ninety per cent. of the seemingly more substantial buildings had been either destroyed or very seriously damaged by the force of the earthquake shock alone. The number of human lives blotted out by the catastrophe was then and will probably forever remain unknown, but the true number is doubtless somewhere between one thousand and two thousand. At the time of my return, eight days after the disaster, the streets had been sufficiently cleared of débris for the passage of carriages, but remains of human bodies were still occasionally being recovered from the ruins of the buildings. As is usual in cases of earthquake, the wooden houses had suffered the least of any, and as my collections made in the Kingston Harbor and vicinity happened to be stored in such a building which the subsequent fire did not reach, I had the fortune of finding all my specimens of algae safe and uninjured. I was also greatly relieved to discover that comparatively little damage had been done in the Hope Gardens, which are about six miles outside of Kingston, though Superintendent Harris's home, in which I had enjoyed the privilege of residence during my stay in that region, had been rendered uninhabitable for the time being. In leaving Kingston Harbor for New York on the morning of January 24, it was of much geological interest on passing Port Royal at the harbor's mouth to note the evidences of a considerable subsidence at this point as a result of the earthquake. The former sandy and pebbly beach had disappeared, the water now reaching the sod-covered soil, and a group of cocoanut-palms previously, of course, growing on *terra firma*, was now partially submerged, their crowns and the upper parts of their trunks appearing above the ocean at a distance of several yards from the present shore-line (Fig. 14).

The marine algae secured on this expedition to Jamaica comprise possibly 3,000 specimens, representing 605 collection numbers. As usual, the dried material for the herbarium was supplemented by specimens preserved in fluids. The marine flora of Jamaica had previously received considerable attention and is perhaps as well known as that of any of the West Indian islands with the possible exception of Guadeloupe and Barbados. Sir Hans Sloane, who lived in Jamaica from December, 1687, to March, 1689, was apparently the first to collect, figure and describe any of its seaweeds, and his descriptions and the specimens that he carried back to England were cited by Linnaeus, Ellis & Solander, Dawson Turner, and other of the earlier writ-

FIG. 14. View showing subsidence at Port Royal as result of earthquake of January 14, 1907. The former sandy beach has disappeared, and cocoanut-palms at the point of the peninsula are now surrounded by water and partially submerged.

ers. In more recent years, the lamented Dr. James Ellis Humphrey, who in 1897 fell a victim there to the "island fever," Dr. J. E. Duerden, then of the Institute of Jamaica, and Mrs. Cora E. Pease and Miss Eloise Butler, who made visits to the island in 1891, 1894, and 1900, have brought together somewhat extensive collections which have formed the basis of Mr. F. S. Collins' paper on "The Algae of Jamaica," published in 1901. Mr. Collins' list includes 224 marine species.

The specimens now secured will add a considerable number to this list, though several there mentioned were not observed. It is to be hoped that at some time in the near future it may be possible to make another visit to Jamaica in order to explore especially its northern and eastern shores, which should materially supplement the present representation of the Jamaican marine flora in our herbarium.

Respectfully submitted,

MARSHALL A. HOWE,

Curator.

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NOTES, NEWS AND COMMENT.

Professor William Trelease, director of the Missouri Botanical Garden, left St. Louis on January 24 for an expedition to the West Indies.

Mr. John F. Cowell, director of the botanical garden at Buffalo, paid the Garden a visit early in March to examine the living collections of tropical and desert plants.

Dr. John A. Shafer, Museum Custodian, returned on the first of March from a collecting trip of several weeks duration in the island of Montserrat, West Indies.

Bulletin No. 17, containing the annual reports of the Director-in-Chief and his associates for the year 1906, appeared March 7, 1907.

Mr. W. T. Horne, who spent considerable time at the Garden in 1903–'04 while holding the fellowship in botany in Columbia University, has been appointed head of the department of plant pathology in the Estación Central Agronómica de Cuba, a position recently held by Dr. M. T. Cook.

Volume 7, part 1, of the North American Flora, contributed by Professor J. C. Arthur, of Purdue University, Lafayette, Indiana, appeared March 6, 1907. This part is devoted to two families and a portion of a third in the large and important group of parasitic fungi popularly known as rusts (Uredinales).

The total precipitation recorded for the month of February was 2.19 inches, of which there were 11 inches of snowfall on the 5th, 1 inch on the 6th, and 6 inches on the 25th, making a total of 18 inches of snowfall for the month. Maximum temperatures were recorded of 47° on the 2d, 48° on the 10th and 14th, and 37° on the 20th; also minimum temperatures of — 2° on the 6th, 1° on the 13th, 3° on the 23d, and 2° on the 27th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

25 specimens "North American Musci Pleurocarpi." (By exchange with Dr. A. J. Grout, for the Columbia University Herbarium.)

20 specimens of fungi from England. (Distributed by Mr. C. E. Hartley-Smith.)

25 specimens of fungi from Utah. (Distributed by Professor A. O. Garrett.)

70 specimens of flowering plants and ferns from central New York. (Given by Dr. J. V. Haberer.)

2,800 specimens of marine algae from Jamaica. (Collected by Dr. M. A. Howe.)

245 specimens of hepatics from North America. (Given by Miss Caroline C. Haynes.)

47 herbarium specimens from Utah and Idaho. (By exchange with Oberlin College.)

125 specimens, being the plants collected on the late Peary Polar Expedition. (Given by Dr. L. J. Wolf.)

8 specimens of fungi from various localities. (By exchange with the Royal Gardens, Kew, England.)

71 specimens of fungi from western Pennsylvania. (Given by Professor D. R. Sumstine.)

11 specimens of fungi from Europe. (By exchange with Dr. P. Sydow.)

15 specimens of fungi from southern California. (Given by Mr. S. B. Parish.)

4 specimens of parasitic fungi. (Given by Dr. M. T. Cook.)

92 specimens of fungi from Mississippi. (Given by Mrs. F. S. Earle.)

200 museum specimens of marine algae from Jamaica. (Collected by Dr. M. A. Howe.)

163 specimens of fungi from Honduras. (Collected by Mr. Morton E. Peck.)

113 specimens of fungi from the Philippine Islands. (Given by Professor A. D. E. Elmer.)

7 specimens of fungi from Pennsylvania. (Given by Professor D. R. Sumstine.)

70 specimens of fungi from Vermont. (Given by Miss Gertrude S. Burlingham.)

1 specimen of Ravenelia Piscidiae. (Given by Professor J. C. Arthur.)

15 specimens of fungi from various localities. (Given by Mr. Perley Spaulding.)

30 specimens of fungi from Jamaica. (Given by Dr. D. S. Johnson.)

PLANTS AND SEEDS, FEBRUARY, 1907.

2 plants for the conservatories from Mexico and Lower California. (By exchange with National Museum through Dr. J. N. Rose.)

1 plant for the conservatories from Acklin's Is., Bah. (Collected by Mr. L. J. K. Brace.)

1 plant for the conservatories. (Given by Mr. Pauls.)

1 packet of seeds from Biscayne Bay, Fla. (Collected by Dr. J. K. Small.)

2 packets of seeds from Holland. (By exchange with Professor H. DeVries.)

20 packets of seeds from West Australia. (By exchange with Mr. C. S. Thorp.)

35 packets of seeds from S. California. (Given by Mr. S. B. Parish.)

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REPORT ON THE CONTINUATION OF THE BOTANICAL EXPLORATION OF THE BAHAMA ISLANDS.

To the Scientific Directors.

Gentlemen: Pursuant to your authorization I continued botanical exploration in the Bahama Islands during parts of February and March of this year, being absent from the Garden for this purpose from February 11 to March 29. I was accompanied by Dr. C. F. Millspaugh, curator of botany in the Field Museum of Natural History in Chicago, who has been coöperating with me in previous work in this field, the expenses of several expeditions and the museum and herbarium specimens obtained having been divided by the two coöperating institutions. I was also accompanied by Mrs. Britton, who rendered much assistance in collecting and preparing specimens, and at Nassau the expedition was joined by Mr. L. J. K. Brace, a botanist resident there, who had previously done much collecting in various parts of the archipelago in the interests of this investigation, his remuneration and collections being also divided between the Garden and the Field Museum.

Dr. Millspaugh, accompanied by Mrs. Millspaugh, proceeded to Nassau by steamer from New York, while Mrs. Britton and I went by way of Florida; this course permitted me to revisit the Subtropical Laboratory of the United States Department of Agriculture at Miami, Florida, now in charge of Dr. Ernst A. Bessey, the base which has been used by the Garden's several exploring expeditions in southern Florida. The valuable experimental work of this institution is being vigorously continued, especially in plant breeding investigations, and its usefulness as a scientific center has been much increased by the purchase of a power-launch, secured by private subscription which was aided by several members of the Garden. By means of this boat we now expect to obtain a much more complete knowledge of the plants of the Florida keys and of the mainland shores, its use being provided without further expense to the Garden. I discussed some details of this desirable work with Dr. Bessey, and also plans for the further exploration of the Everglades, and hope to be able to detail Dr. John K. Small, head curator of our Museums, to make a part of the needed exploration this year, in continuation of his previous studies, inasmuch as it is most important that the flora of southern Florida be as accurately known as possible by the time the botanical survey of the Bahamas is completed, there being an intimate relationship between the floras of these two regions.

Arriving at Nassau by steamer from Miami on February 14, two days were given to outfitting and to the collecting and observation of certain plants growing on the island of New Providence, relative to which additional information was desired. Mr. Brace was commissioned to explore the northern part of Andros Island, situated some 30 miles west of New Providence, where a number of species known in the Bahamas only from that region were collected in 1890 by Dr. and Mrs. John I. Northrop. Dr. and Mrs. Millspaugh had reached Nassau two days before our arrival and had attended to most of the details of preparation for our trip to the out-islands, and on February 16 the party sailed for Eleuthera on Mr. W. J. Pinder's staunch schooner "Nellie Leonora," previously chartered for our use, and used by us during our cruise to the northern Bahamas and to the Exuma Islands in 1905. The landing point sought was the picturesque cleft with steep rocky walls, called the "Glass Window," where Eleuthera Island is very narrow, though its total length is more than 70 miles; here easterly storms send the surf through in tremendous volume and with magnificent force. This point is distant only about 60 miles from Nassau, but very light winds delayed our arrival until late in the morning of February 17. We immediately landed and walked northward about two miles to the beautiful nearly land-locked bay on which the town of Harbour Island is situated, obtaining among other interesting plants additional living specimens of the Bahaman agave which we had previously seen on many other islands, but which grows here in large quantities, and some plants were in full flower. The plant is really so abundant at this point as to give character to the landscape and is known by the natives here as elsewhere under the name of bamboo. We reached the town by sail-boat and here Mrs. Britton and Mrs. Millspaugh remained for two weeks, Mrs. Britton exploring northern Eleuthera, while Dr. Millspaugh and I returned at once to the "Glass Window" where the schooner awaited us and proceeded with the study of the flora of Eleuthera from that point southward.

On February 18, we walked southward about five miles to Gregory Town, the schooner preceding us along the coast. This walk and the one of the previous day gave us a very good idea of the flora of the north-middle part of the island; the most interesting plant secured was a small cycad (genus *Zamia*) with very narrow leaf-segments growing in white sand in the shade of shrubs, evidently a rare species, as this is the only point known to us where it occurs, although we were told that it grows elsewhere on this island; like the other Bahaman *Zamias* it is called "bay rush" and its roots furnish starch similar to that obtained from the sago palms (genus *Cycas*). Near Gregory Town we saw the spiny shrub *Catesbaea spinosa*, with its large drooping yellow flowers, dedicated by Linnaeus to Mark Catesby, a celebrated botanist who explored some of the Bahama Islands in 1725 and 1726 and subsequently published two folio volumes with two hundred colored plates entitled "The Natural History of Carolina, Florida, and the Bahama Islands," a rare work, of which our library possesses a good copy. It is known that Catesby visited Eleuthera, and it is possible that the shrubs seen by us are descendents of those originally found by him, although the species occurs elsewhere on this island; it is also found on other Bahamian islands and is in cultivation in gardens in Cuba and Jamaica. Sailing south the afternoon of the same day, we reached Governor's Harbor and devoted February 19 and 20 to the study of the vicinity of that town, the bridle road enabling us to cross the island, here less than two miles wide from west to east, and return a different way; we collected specimens of many interesting species on these section lines, some of them not hitherto known from Eleuthera, the best ground being a valley lying parallel to the eastern shore where fresh water wells supply the washerwomen of the town with water. Here there is also a considerable area of fresh water marsh and numerous small plants seldom seen in the Bahamas occur, among them a rare little grass and a purple-flowered aster related to the asters of our own coastal marshes. In white sand near the town we found a showy yellow-flowered *Mentzelia*, new to the Bahamas. Governor's Harbor is a center for the cultivation of pineapples, especially on "red-lands," which occupy swales and valleys where the soil resulting from the washing down of the leached limestone by rainwater contains much iron; these lands are much esteemed in the Bahamas for this industry.

Our next collecting point to the south was Rock Sound, a large shallow bay on which the town of New Portsmouth is situated, which is one of the best harbors for small vessels in the Bahamas; two days were spent here, an east and west road across the island making a cross-section of its vegetation practicable: it may be remarked that the Bahaman scrub-lands and coppices are usually nearly impenetrable, except for very short distances, without a road or trail, owing to the dense growth of the shrubs and trees. In this vicinity we first found the "pepper bush" (*Croton*), a fragrant shrub of the Spurge Family which we had long desired to see growing; a low prickly pear cactus (*Opuntia*) with extraordinary armament of spines was secured for the conservatories, and complete specimens of another shrub of the Spurge Family (*Lasiocroton*) with leaves strikingly reticulated on the under side, hitherto known in the Bahamas only from Andros Island. Sailing south around Powell's Point, the two days of February 23 and 24 were given to a study of the extreme southern part of Eleuthera, where low rocky plains and sand-dunes yielded some species not found further north.

Little San Salvador, an island some 6 miles long and averaging perhaps one mile wide, lies nearly directly east of the southern end of Eleuthera and about 9 miles distant, and here we spent February 25 and 26. It is uninhabited, but some farming is done by people who come from Cat Island, about 9 miles to the east or northeast. The soil is mostly white sand, and indian corn and guinea corn are the principal crops. The island is interesting from the great abundance of the hog cabbage palm (*Pseudophoenix Sargentii*), its common name referring to the use of its trunk for pig food; this palm, which formerly existed in quantities on some of the Florida Keys, but has now been nearly or quite exterminated there, exists on Little San Salvador in thousands, and was in full fruit at the time of our visit, the clustered bright-red three-lobed berries being conspicuous in the landscape. The palm occurs on nearly all the Bahaman Islands, but in the inhabited ones is much used for pig food, and is thus liable to extinction; we already have good specimens in the conservatories both from Florida and from the Bahamas, but a supply of the ripe berries for growing a crop of seedlings was collected. There is excellent fishing on the reefs about this island and a plentiful supply of several kinds was caught in a couple of hours in one afternoon.

The northern end of Cat Island was reached during the night of February 26, and Orange Creek was made the base of operations for the next two days, including a walk under the guidance of a native completely around the northern end of the island, covering some 15 miles or more, the longest tramp that we indulged in, which brought us back to the boat after dark, but with large collections. Cat Island was long supposed to be the land first reached by Columbus and the name San Salvador was applied to it and accepted by the English; in fact, San Salvador is still the name used by the Bahaman government, or at least by some of its departments, though it is now known that the real San Salvador of Columbus is Watling's Island, which lies some 40 miles further to the southeast. It is unfortunate that the name given by Columbus has now been generally abandoned for either island, although an attempt has been made on the sailing charts to restore the name San Salvador to Watling's Island, with the result that when San Salvador is mentioned one is left in doubt as to which island is really meant. In the vicinity of Orange Creek we first saw one of the rarest and most interesting small trees of the Bahamas, apparently related to the trees known in Jamaica as "pride of the valley" (*Spathelia*), classified by authors in the Rue Family, but whose botanical relationship is somewhat doubtful. These trees form slender unbranched trunks bearing large pinnate sumac-like leaves in crowns at the top; they grow for several or many years and then produce a large cluster of flowers and fruit above the crown of leaves, after which they die; the tree was seen again further south on the same island, but in both instances in fruit, its flowers being still unknown.

The Bight Settlement, some 16 miles north of the southern end of Cat Island, was our next collecting ground, and here we went into camp in a house for six days while the schooner sailed back to the "Glass Window," took the ladies on board and carried them to Nassau, returning to us with stores and mail on the morning of March 7. This stay of six days enabled us to obtain a quite complete knowledge of the plants growing within 5 or 6 miles of the Bight, and we secured specimens of a number of rare and interesting species; among these, mention may be made of another practically spineless prickly pear cactus (*Opuntia*) with small red flowers, growing abundantly in rocky soil, and new to our collections, a duck-weed (*Lemna*) not before known in the Bahamas, covering the surface of a small shaded pond and doubtless brought there on the feet or feathers of some migratory bird, specimens of an interesting shrub of the Vervain Family, known in the Bahamas only from Cat Island, and a most viciously spiny *Acacia*, a shrub or small tree to be handled only with great caution. The work on Cat Island was concluded by spending March 8 at Port Howe near Columbus Bluff, a bold rocky headland at the southern end of the island, where, among other interesting plants, good specimens of a rare spiny shrub related to the potato (*Solanum*) were collected, the species being known only from this island and from Great Exuma, about 50 miles to the southwest, where it was found by us on our trip of two years ago.

Cat Island is some 45 miles long and is more hilly that any of the other Bahamas; the charts maintain that it contains elevations of about 400 feet; I ascended several of the hills, which in each case were claimed to be the highest on the island by the residents, but could find no altitude by the aneroid barometer greater than 205 feet, though it is possible that some of the hills may be slightly higher; this cited height of 400 feet had been doubted by Mr. Brace, and so far as my observations go there is probably no elevation as great as that on the island.

Conception Island, lying about 25 miles southeast of Port Howe, was next visited, and studied on March 9 and 10; this is the smallest of the islands studied by us on this cruise, being only about 2 ½ miles long by somewhat less than 2 miles wide. It is inhabited by only one family, and farming operations are carried on on a small scale but are successful. It is highly elevated in places, but the middle part of it is occupied by one of the most continuous and striking level salt-plains that I have seen anywhere in the islands, subject to overflow at high tides, but quite dry at this time. The flora is not strikingly different from that of the islands further north and west, but good living specimens of the tall woolly cactus previously found by us on Cave Cay of the Exuma chain were obtained and the sandy portions of the island were beautified by the trailing white passion-flower of these islands. A few species known hitherto only from farther south were found here.

Watling's Island, topographically, historically, and in some respects botanically the most interesting of the islands visited and the most eastern point reached on our cruise, was explored from March 12 to 15 and we should have been glad to spend more time upon it, for as it was we studied only its northern part. The island is about 12 miles long and 6 miles wide, rather hilly, with a maximum height according to the charts of about 140 feet, and contains numerous salt-water lakes, unconnected with the ocean, the two largest of these occupying perhaps one fourth the total area of the island; these large lakes give a character to the topography and landscape not seen elsewhere in the Bahamas. The course of our exploration during these four days extended from Cockburn Town on the western side across and around the larger lakes to the fine lighthouse on the northeastern side which section was explored from Graham's Harbor at the northeast end southward some five miles to where the monument to Columbus stands, and then from Graham Harbor back to Cockburn Town across the northwestern part of the island. We found the *Agave* ("bamboo") which we were seeking well developed at one point on the shore of the largest lake and obtained good specimens of its fruit, leaves, and young plants for cultivation. As it had passed flowering we were unable to obtain the blossoms. It seems to be somewhat different from the common species of the northern island, having leaves which are much more feebly bristle-margined, and pods which are sharp-pointed and much larger. The common species also grows on Watling's Island and plants were brought along for comparison. The shrub or small tree of the Mallow Family discovered here several years ago by Professor Coker, during the expedition of the Geographical Society of Baltimore to the Bahamas, and named by me *Malvaviscus Cokeri*, was seen in abundance at the type locality where it was obtained by him, and also in many other places along the lakes and on the borders of swamps, and we obtained good specimens of its fruit, which was not before known, as well as of its pretty bell-shaped greenish-red flowers. The plants of the northeastern side of the island proved to be in many instances different from those of the western side and among them we saw for the first time the Bahamian *Mimosa*, a shrub which grows in great quantities on the borders of marshes, but formerly known only from islands further south. Graham's Harbor is very picturesque, its bold cliffs of white limestone contrasting finely with the green vegetation of the shores and the deep blue water of the ocean.

The monument to Columbus erected by the Chicago Herald in 1891 stands on a headland about five miles south of the northern end of the island on the eastern side, and we were much interested, of course, in going to the locality determined at that time as the most probable point where Columbus first landed, and in taking note of the plants which he presumably saw here. These are all well known Bahaman species and species growing also on the shores of many other West Indian islands; it is probable that the one which first attracted the discoverers of America was the sea-grape (*Coccoloba Uvifera*), a common shrub or tree of all West Indian sea coasts, which gets its common name from its edible grape-like bunches of fruit. The headland on which the monument stands is locally known as Crab Cay. The structure is unpretentious and was believed by my companion from Chicago to be a chimney of a ruined house until he reached it; it is about 12 feet high and constructed mainly from loose rocks picked up in the vicinity; it bears a marble globe with an outline of the continents engraved upon it and a marble slab which states that at this point Columbus first set foot upon the soil of the new world. A small cube of granite and a brick, which we were informed by one of our sailors, a native of Watling's Island, was brought from the house of Columbus in Genoa, complete the decoration of the monument.

Our explorations were completed by a visit to Long Island, lying some 50 or 60 miles southwest of Watling's Island, where there is one good harbor on the eastern side at Clarence Town, which was made a base of operations from March 16 to 19. Long Island lies on the same bank as the Exuma Islands, which we explored two years ago, and contains many of the species which we collected on that chain; a few were found which we had not before collected in the Bahamas, the most interesting of these being a low spurge (*Euphorbia*). Sailing north from Clarence Harbor, or rather drifting, as we were here delayed by two days of calm, we touched for a few hours at Cape St. Maria at the northern end of Long Island on March 21 and returned to Nassau, arriving there early in the morning of March 23, and proceeded to pack the collections, Dr. Millspaugh returning to New York on the Royal Mail Steamer "Oronoco" on March 25, Mrs. Millspaugh having preceded him, and Mrs. Britton and I returning on the twenty-sixth by way of Miami.

Having March 27 at Miami, I was enabled to again visit the Subtropical Laboratory of the United States Department of Agriculture and to select some plants for our conservatories and to collect some specimens in the vicinity. We reached New York on the afternoon of March 29.

Our work in the Bahamas was aided in many ways by the residents, and our thanks are due and are gratefully tendered for information and assistance to Hon. Herbert A. Brook, Registrar of the Colony at Nassau; to Rev. John P. Jackson of Rock Sound, Eleuthera; to Andrew S. M. O'Brien, Esq., Resident Justice; to Rev. C. P. Shaw of the Bight Settlement, Cat Island; to Mr. Simeon Devoe, Assistant Resident Justice, at Port Howe, Cat Island; to Mr. F. L. Christie of Conception Island; to Rev. Marshall M. Cooper, and Resident Justice Rigby of Cockburn Town, Watling's Island, and to R. G. Williams, Esq., of the Harbor Estate, Watling's Island; to Rev. C. B. T. Wilkinson, M.A., Resident Justice, Gilbert Albury and Charles A. Abbott, Esq., of Clarence Town, Long Island.

Before leaving Nassau, I had a very pleasant interview with Sir William Grey-Wilson, governor of the Bahamas, and consulted with him relative to the additional exploration work which is necessary to make our survey complete, in so far as an examination of islands as yet unvisited by us or our agents will complete it. The principal points still remaining for examination are the southeastern islands of the archipelago, including the island of Samana, Miriguana Island, the several islands of the Caicos bank, the Ragged Cays, and at the extreme southwest of the archipelago the small islands on the Cay Sal bank. I secured from Mr. Pinder the use of the same schooner for a proposed trip to these islands toward the end of the present year. The governor was much interested in the further exploration of Andros Island, the largest of the group, and the nearest large island to New Providence. The interior of this island at its widest part, which is 40 miles or more, is unknown, either geographically or botanically, having never been penetrated, and no one knows what the conditions are in this terra incognita. He assured me of governmental coöperation at some future time when it might be convenient to attempt the penetration of this presumable wilderness, and I hope that we may be able to explore it.

Respectfully submitted,

N. L. Britton,
Director-in-Chief.

REPORT ON A VISIT TO THE ISLAND OF MONTSERRAT.

Dr. N. L. Britton, Director-in-Chief.

Sir: Pursuant to your instructions, I visited the island of Montserrat, and spent about five weeks there in botanical exploration. I embarked from this city on the Quebec S. S. *Korona,* January 5, landing at St. John's, Antigua, on January 15, where I was somewhat delayed, awaiting an opportunity to cross over to Montserrat, which presented itself on the night of the 17th in the shape of a little sloop, on which I secured passage. Arriving off Plymouth about dawn the next morning, I was quickly passed by the officers of the port and shortly after 7 o'clock found myself in the delightful home of Mr. F. W. Driver, of the Montserrat Company, to whom I had letters of introduction from Mr. T. A. Hedley, their agent in New York. Mr. Driver became very much interested in our proposed work, and after giving me much timely advice drove with me to the house of Mr. Dudley Johnson, on Cocoanut Hill, where I secured accommodations and made headquarters during my stay on the island. The remainder of the day was consumed in securing and arranging my equipment, recovering from the effect of the previous night's experiences on the sloop, and becoming acquainted with my surroundings. The next day, January 19, just two weeks after leaving New York, I was at work collecting the plants of the region immediately surrounding my headquarters, and exploring a nearby "gut," as the deeply eroded ravines are called. During the weeks that followed almost continuous collections were made in all sections of the island.

Owing to the ruggedness of the country, the multiplication of distances by the necessarily circuitous roads and trails, and the steepness of the mountain sides, the employment of horses and negroes was a very necessary inconvenience. Much time was also lost by the nightly return to headquarters, which the lack of suitable camping facilities made necessary, especially as it was prudent to get back, at least to good roads, before the early tropical darkness set in. The exploration of the higher and floristically richer portions of this or similar islands would be greatly expedited if one were equipped so as to be able to remain in the higher altitudes several nights in succession.

My plants were dried in numerous well-ventilated packages of dryers not over three inches thick. These were spread out in the sunshine and frequently turned; also promptly brought under cover in case of showers, which occurred rather frequently, by a boy who was employed for this and other purposes about headquarters. This arrangement expedited matters very materially and relieved me of much anxiety concerning the undried material while afield.

Active exploration was kept up to within a day of the time of departure, early in the morning of February 21, when I took passage on a Royal Mail steamer for Antigua, where I had a day and a half to await the S. S. *Parima* for New York, thus giving me time to have the partially dried specimens taken to the botanical station at St. John's. Facilities were kindly put at my disposal there, which, with a day of bright sunshine, enabled me to dry most of them and prepare the remainder for the rest of the voyage, through which they came in good condition, arriving in New York with me at noon, March 2, just eight weeks from the time of departure, three of which were consumed in transit.

Montserrat, situated in latitude 16° 45′ north and longitude 61° west, is one of the British administrative group called the Leeward Islands. It is about 27 miles southwest of Antigua, the seat of government, but about 40 miles from port to port, its greatest length, 11 miles, being approximately north and south, while its greatest width is 7 miles. The outline is quite irregular and is estimated to contain about 40 square miles. The island is wholly volcanic in origin and is very mountainous, the highest peak, Chance's mountain, reaching an altitude of 3,000 feet, while several others are 2,500 feet or more in height. The coast is generally very rugged, except for a narrow beach on either side of Plymouth, about three miles long, and one of smaller extent on the windward side. There are no enclosed bays and the several salt marshes are very small. Two of those which I explored contained little of interest, except for the fact that most of the species one would expect to find there were absent. In one I found a few small bushes of black mangrove, *Avicennia nitida* L. A third marsh, which I saw from the distant hills, is said to contain mangroves, but I was unable to visit it or to ascertain which of the three genera they represented.

The beach affords the usual plants common to a similar environment throughout the West Indies, while the old-world plants, *Vinca major* L., the periwinkle of our gardens, and *Calotropis procera* R. Br., the so-called French cotton, were very conspicuous, the former exceedingly abundant. The much-feared manchioneel, *Hippomane mancinella* L., is very abundant and reaches large dimensions. The most common woody plants near by are "wild coffee," *Clerodendron aculeatum* (L.) Griseb., "French cashaw," *Prosopis juliflora* DC. and the "cashaw," *Acacia tortuosa* Willd., the latter very common throughout the dryer portions of the island. On the coastal cliffs the dry thickets are composed of a variety of shrubs and stunted trees, conspicuous among them being several species of *Croton*, *Plumieria alba* L., and a tall upright cylindrical cactus belonging to the genus *Cereus*.

On the windward side the bleak wind-swept cliffs support a species of *Agave*, two prickly pears, *Opuntia*, a Turk's-cap cactus, *Melocactus*, and *Plumieria alba* L., while the more gentle slopes are covered with an impenetrable thicket composed mostly of the currant tree, *Jacquinia armillaris* L., and "white cedar," *Tecoma Leucoxylon* Mart. The northern end of the island is very rough, rocky and dry, its highest point, Silver Hill, being less than 1,300 feet. It is covered with a xerophytic growth composed largely of the above-mentioned plants, together with fiddle-wood, *Citharexylum quadrangulare* Jacq., white alley, *Guettarda*, three or four species of *Coccoloba*, and a great variety of other woody plants in lesser numbers, among which are found several orchids and bromeliads, one curious association being an attractive yellow-flowered orchid growing among the spiny stems of a tall cactus. On the wider portion of the island the slope from the sea to the base of the mountains which run east of the longitudinal axis is quite gradual and is under cultivation, except where the spaces between the deeply eroded guts are too difficult of access. These guts as a rule are very dry and barren, and are strewn with large boulders, showing the effect of the torrents that occasionally rush through them. The most conspicuous, if not the commonest, plant here is the silver fern, *Gymnogramme calomelanos* Kaulf. Near the mountains the guts retain more moisture and harbor many of the plants common to their tributaries higher up the mountain ravines.

The mountains, which begin their usually abrupt ascent at an altitude of 1,000 to 1,200 feet, support a luxuriant and constantly increasing vegetation, except on wind-swept exposures. This consists of a variety of hard-wood trees, among them Spanish cedar, *Cedrela odorata* L., snake wood, *Ormosia dasycarpa* Jacq., "Spanish oak," *Inga laurina* Willd., galba, *Calophyllum Calaba* L., "locust," *Hymenaea Courbaril* L., two kinds of burwood, *Sloanea*, bayberry, *Amomis caryophyllata* (Jacq.) Krug. & Urb., and a great variety of shrubs, among them many kinds of *Melastomaceae*, a *Podocarpus* and *Weinmannia pinnata* L. A tall tree fern, *Cyathea arborea* Swartz, often 25 feet high, is very abundant and frequently forms dense, almost pure, forests up to 2,000 feet, where it is replaced by the mountain cabbage palm, *Euterpe oleracea* Mart., which also forms almost pure growths extending to the highest summits. Throughout all this range there is a great variety of smaller flowering plants both terrestrial and epiphytic representing many genera, such as *Begonia*, *Piper*, *Peperonia*, *Marcgraavia*, *Heliconia*, *Philodendrum*, and *Carludovica*, together with orchids, bromeliads and ferns in great profusion.

Three very small bodies of fresh water, all that I could hear of, were visited, the highest in elevation being Chance's pond, situated at an altitude of about 2,800 and at a short distance from the top on the eastern side of the mountain of that name. This pond was very disappointing, as it contained no characteristic aquatic plants of interest, neither did its margins support a flora differing materially from that on the surrounding mountain sides. Two ponds in the northern end of the island harbored a few plants each of the water lettuce *Pistia stratiotes* L., while the larger one, on Silver Hill at an elevation of about 1,100 feet, also contained two or three plants of the white water lily, *Castalia ampla* Salisb.

The Soufrières, of which there are three, are not, as usually supposed, situated on the mountain tops, but in deep ravines at an altitude of about 1,300 feet. They consist of numerous fissures containing boiling water and emitting steam and sulphurous vapors, surrounded by deposits of sulphur, white, yellow and red earth and rocks strewn with charred wood, parched grass, and an occasional dead tree or fern trunk still standing. The vegetation nearest to them consists of mosses and slime-like algae within and bordering the streamlets of hot water, the higher plants thriving nearest being a large bluish *Cyperus*, a low tree-like *Lycopodium* called hartshorn, two or three species of ferns belonging to the genus *Dicranopteris*, and a bromeliad with brilliant scarlet inflorescence.

Botanically this island is scarcely known, the only collections of plants made thereon, that we have any knowledge of, having been collected about 1802 by a Dr. John Ryan. I was unable to obtain any information about Dr. Ryan during my visit, and there are no white men of that name on the island now.

Economically, Montserrat has been in an unenviable position for sometime past, owing to the visitation of serious earthquakes, floods and hurricanes in rapid succession during the last twenty years, which, added to the depression already caused by the constantly declining price of sugar has reduced the white population to less than 100 persons among a total of nearly 14,000 inhabitants. It is distressing to look upon the great piles of stone, the ruins of once stately plantation buildings and spacious mansions and see near by the cheaply constructed makeshifts that have taken their place. On the other hand, the negroes seem to have profited to some extent, as these conditions have made it possible in many cases to acquire small areas of land, so that several of the larger estates are also held by them.

Sugar, formerly the staple product, has become unprofitable, chiefly owing to the fact that the primitive process of extraction, in which scarcely half of the saccharine contents of the sugar cane is secured and that of an inferior quality, is still in vogue. If a central factory were established on a modern basis, the industry would no doubt still be remunerative, but the transportation of the bulky cane over such a rough territory would make the project seem impractical even if sufficient capital to establish the factory were forthcoming.

Although Montserrat is known to the public almost wholly on account of its lime juice, this fruit and its products are produced on a commercial scale only by one concern, the Montserrat Company, a British corporation which owns many of the best estates and has hundreds of acres planted with limes. The output of fresh juice, however, is contracted for by another British company in such a way as to give them a complete monopoly of this product. Although considerable more juice is extracted than this concern handles, it is quite impossible to obtain it for shipment into the United States; the surplus is concentrated to about 12 per cent. of its bulk or neutralized with a calcium salt, forming citrate of calcium, both products being commercial sources of citric acid. Considerable volatile oil of limes is also produced.

Arrow-root, the starch obtained from the tubers of *Maranta arundinacea* L., is produced in large quantities and of very superior quality. Papain, a digestive substance similar to pepsin, obtained from the milky juice of the "papaw," *Carica Papaya* L., was formerly produced in considerable quantities and constituted an important industry, but competition from Asiatic countries, it is said, has reduced the price so that it is no longer profitable. The large green fruits are scraped and the juice which flows for a few minutes is collected in a small vessel, this operation being repeated a number of times until the fruit begins to ripen. The fresh juice is brought to persons who prepare the papain, and is paid for by volume. This industry formerly furnished an income for a great many persons without capital, for the plant is very abundantly spontaneous in many places.

Cacao, the seeds of *Theobroma Cacao* L., is being successfully grown in the central mountains, especially by the Montserrat Company, which also has experimental plantations of vanilla, pepper, pimento and nutmegs.

Bay oil, the volatile oil obtained from the leaves of *Amomis caryophyllata* (Jacq.) Krug. & Urb., a tree common in some of the mountains, is also produced in considerable quantities. It is the basis of the popular toilet article known as bay rum.

Vegetables in great variety are grown, mostly by the peasants in their "provision lands," which are usually situated in a fertile spot on the side of a mountain, at from 1,000 to 2,000 feet altitude. These are often so steep that the soil must be held up in step-like fashion by logs, usually the slender trunks of a tree fern, kept in position by several stakes driven below them. Here are grown in promiscuous confusion sweet potatoes, yams, tanyas, arrow-root, okra, tomatoes, egg-plant, peppers, squashes, beans, etc. Bananas and plantains are also grown here. The peasants also grow with less success such products of temperate gardens as potatoes and cabbage, but these are usually a failure during the summer months.

The cultivation of Sea Island cotton has been carried on very successfully and on a considerable scale for several years, and the product from this island has been bringing excellent prices in England. It is to be hoped that this will continue and that the practical results will equal the not too modest expectation of those who advocate the planting of "cotton, cotton and more cotton." If it will do for the whole island what it is reported to have already done for one or two estates, it will deserve to replace the ancient emblem of salvation now prominently displayed on the coat-of-arms of the island.

This report would be incomplete if I failed to mention my obligations to His Honor, Lt. Col. W. B. Davidson-Houston, Commissioner of Montserrat, for the gracious interest he displayed in our work; to Mr. Fred. W. Driver for favors already mentioned; to Mr. W. Robson, curator of the botanical station, for his personal interest and enthusiasm constantly displayed, and for the sacrifices and discomforts endured on my behalf in the ascent of Chance's Mountain and other excursions; to Mr. Dudley Johnson, my host, and to Mr. E. Gilks, his manager at Roches, for facilities afforded while in that most interesting but inaccessible region; to Miss H. Kirwan for the gracious manner in which she dismissed the charges of trespass so seriously filed against me by an over-zealous servant while collecting on Fergus Mountain, on one of her estates; to Mr. J. T. Allen, editor of the Montserrat Herald, for his personal guidance through the higher mountain ravines of his remarkable estate; and to Mr. Jackson, curator, and to Mr. Thibou, foreman of the botanical station at Antigua, for aid and facilities afforded me at that institution.

Respectfully,

J. A. Shafer,
Museum Custodian.

SPRING LECTURES, 1907.

To be delivered in the lecture hall of the museum building of the garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

April 27. "The Life Story of a Tree," by Dr. C. Stuart Gager.

May 4. "The Flowers of Trees and Shrubs Growing Wild near New York City," by Dr. N. L. Britton.

May 11. "Jamaica: Its Flora, Scenery, and Recent Disaster," by Dr. M. A. Howe.

May 18. "Water Lilies and other Aquatic Plants; their Relation to Horticulture," by Mr. G. V. Nash.

May 25. "The Influence of Vegetation in the Formation of Recent and Ancient Swamps," by Dr. Arthur Hollick.

June 1. "Some Little Known Edible Fruits of the United States," by Dr. H. H. Rusby.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5.34 train from the Botanical Garden railway station, arriving at Grand Central Station at 6.05 P.M.

The museum building is reached by the Harlem Division of the New York Central and Hudson River Railway to the Botanical Garden Station, by trolley cars to Bedford Park, or by the Third Avenue Elevated Railway to Botanical Garden, Bronx Park.

NOTES, NEWS AND COMMENT.

Dr. E. B. Copeland, of the Bureau of Education of the Philippine Islands, called at the Garden on April 1.

Dr. Kristine Bonnevie, Konservator at the University of Kristiania, visited the garden on March 29.

Professor A. W. Evans spent a few days at the Garden during the last week in March, consulting the Mitten collection of mosses, recently acquired by the Garden Herbarium.

Professor Edward A. White, of the Department of Botany, Forestry, and Landscape Architecture of the Connecticut Agricultural College, Storrs, Conn., was at the Garden on March 29, consulting the Herbarium. Professor White removes to the Massachusetts Agricultural College on July 1, where he has been appointed to the newly established professorship of floriculture.

Dr. Melville T. Cook, who has been pursuing investigations in the laboratories of the garden during the preceding three months, has received an appointment, under the Adams act, as Plant Pathologist at the Delaware Agricultural Experiment Station, Newark. The appointment took effect on April 1. Dr. Cook will at once enter upon a study of fruit diseases, giving special attention to the crown-gall affecting the genus *Rubus*.

The New York Academy of Sciences will commemorate on May 23, the two hundredth anniversary of the birth of Linnaeus. In the morning of that day there will be addresses at the American Museum of Natural History and an exhibition of animals, minerals, and rocks known at the time of Linnaeus; in the afternoon, in Bronx Park, there will be addresses and exhibits at the Botanical Garden and the Zoölogical Park and the dedication of the Linnaean Bridge; in the evening, there will be simultaneous exercises at the Museum of the Brooklyn Institute and at the New York Aquarium.

Construction work during the winter has been mainly restricted to the excavation of stone from the ledges in the rear of the Museum building, a small force of men and carts having been used continuously, the stone taken out being used for the telford foundation of roads and paths and deposited on grades prepared during the autumn. The foundations for all the paths on the Fruticetum have now been laid, and the driveway along the east side of the Bronx River, from the Long Bridge north to Newell avenue, is nearly all paved. As soon as a supply of broken traprock and screenings can be obtained, these paths and roads may be completed.

Dr. and Mrs. N. L. Britton and Dr. C. F. Millspaugh returned during the last week in March from a successful botanical survey of some of the outer islands of the Bahamian archipelago. Visits were made to Eleuthera, Little San Salvador, Cat, Conception, Watlings and Long Islands. This was the fourth in the series of expeditions made by Dr. Britton to the Bahamas, and the third by Dr. Millspaugh. The large amount of material thus brought together, supplemented by collections made for the New York Botanical Garden by Nash and Taylor and by Brace, and the earlier collections of the Northrops, of Hitchcock, and of Coker, will serve as a tolerably satisfactory basis for a descriptive treatment of the interesting flora of these islands.

The Garden recently purchased from Mr. Charles H. Sternberg, of Lawrence, Kansas, a choice collection of 44 selected specimens of Cretaceous (Dakota Group) fossil leaves, which includes one of *Liquidambar integrifolia* Lesq., the ancestor of our sweet gum, about 8 inches in length by 11 inches broad; a branch of *Andromeda Pfaffiana* Heer, with six leaves attached; two specimens — counterparts — of the fruit of *Ficus neurocarpa* Hollick, first described in the Bulletin of the Torrey Botanical Club for February, 1903, and seven other leaves which apparently represent undescribed species. The two species last mentioned are of special interest for the reason that fossil leaves are seldom found attached to the parent stem and the fruit of figs are exceedingly rare as fossils.

Professor Theodore D. A. Cockerell, of Boulder, Colorado, recently transmitted to Dr. Hollick a collection of undescribed fossil plant remains from the Tertiary beds of Florissant in that state, with the request that he examine and describe them. Among them are several beautifully preserved flowers and fruits and a moss with fruiting capsules. The matrix is a fine shale in which the impressions of the outlines and even the delicate tissues of the anthers and petals of one of the flowers are clearly defined. An illustrated description of the moss by Dr. Hollick and Mrs. Britton is now in press for the Bulletin of the Torrey Botanical Club and the other remains are being critically examined and will be figured and described in the near future.

The total precipitation recorded for the month of March was 2.31 inches. Of this amount 7 inches fell as snow. Maximum temperatures were recorded of 50.5° on the 2d; 50° on the 9th; 61° on the 17th; 77° on the 23d; and 75° on the 29th; also minimum temperatures of 9.5° on the 7th; 9° on the 12th; 26° on the 21st; and 28.5° on the 26th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM FEBRUARY 1 TO APRIL 15.

ALYON, PIERRE PHILIPPE. *Cours de botanique pour servir à l'éducation des enfans de S. A. le Duc d'Orléans.* Paris, 1787–88.

ASCHERSON, P. & OTHERS. *Botanik von Ost-Afrika.* Leipzig, 1879.

AUTRAN, E. & DURAND, F. *Hortus Boissierianus.* Genève, 1896.

BEIJERINCK, M. W. *Beobachtungen und Betrachtungen über Wurzelknospen und Nebenwurzeln.* Amsterdam, 1886.

Bergen's Elements of Botany. Key and flora, Southern States edition by S. M. Tracy. Boston, 1899. (Given by Dr. L. M. Underwood.)

Botanical Letters. 109 letters from botanists from the collection of Mr. J. J. Crooke. (Given by Miss Vail.)

BROCKMANN-JEROSCH, H. *Die Pflanzengesellschaften der Schweizeralpen.* I Teil. Die Flora des Pushlav. Leipzig, 1907.

ČELAKOVSKÝ, LADISLAV. *Beiträge zur Fortpflanzungsphysiologie der Pilze.* Prag, 1906.

CIRILLO, DOMENICO. *Plantarum rariorum regni Neapolitani.* Neapoli, 1788. (Given by Miss Vail.)

CORRENS, C. *Gregor Mendels Briefe an Carl Nägeli 1866–1873.* Leipzig, 1905.

COUTINHO, A. X. L. *Curso de silvicultura.* Lisboa, 1886. 2 vols.

DETMER, W. *Botanische und Landwirkschaftliche Studien auf Java.* Jena, 1907.

DIELS, L. *Jugendformen und Blütenreife im Pflanzenreich.* Berlin, 1906.

FITTING, HANS. *Die Reizleitungsvorgänge bei den Pflanzen.* Wiesbaden, 1907.

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PICTURE COLLECTION.

398 reproductions of botanists' portraits. (Given by Dr. D. T. MacDougal.)

24 pictures of trees from various sources.

24 portraits of botanists from the Torrey collection.

79 pictures from various sources.

2 portraits of Mr. C. G. Lloyd. (Given by Dr. L. M. Underwood.)

22 plates from the "Botanical Magazine." (Given by the Royal Gardens, Kew.)

1 framed colored print: portrait of Gérard. (Given by Charles F. Cox, Esq.)

1 framed colored print: portrait of Bernard de Jussieu. (Given by Charles F. Cox, Esq.)

107 plates from Jaume St. Hilaire, Plantes de France. (Given by Miss Vail.)

7 illustrations in the greenhouses of the New York Botanical Garden.

6 photographs of a sugar mill in Cuba. (Given by Dr. L. M. Underwood.)

1 photograph of Dr. Charles E. Bessey. (Given by Dr. Charles E. Bessey.)

MUSEUMS AND HERBARIUM.

73 specimens of flowering plants from British America. (By exchange with the Geological and Natural History Survey of Canada.)

6 specimens from Colorado. (By exchange with Professor T. D. A. Cockerell.)

2 specimens of *Crataegus* from Vermont. (Given by President E. Brainerd.)

50 specimens "Phycotheca Boreali-Americana," Fascicle 27, for the Columbia Herbarium. (Distributed by Messrs. Collins, Holden and Setchell.)

15 specimens of *Crataegus* from Rochester, N. Y. (Given by Mr. J. Dunbar.)

31 specimens of *Crataegus* from Missouri. (By exchange with Mr. E. J. Palmer.)

25 specimens of flowering plants from the eastern United States. (Given by Mr. K. K. MacKenzie.)

18 specimens of *Crataegus* from New York. (Given by Mr. W. W. Eggleston.)

747 specimens of flowering plants from Montana. (By exchange with Professor L. M. Umbach.)

9 specimens of *Crataegus* from the vicinity of Philadelphia. (By exchange with Mr. B. H. Smith.)

2 specimens of *Crataegus* from Rochester, N. Y. (Given by Mr. M. S. Baxter.)

7 specimens of flowering plants from the Philippine Islands. (By exchange with the Bureau of Science, Manila.)

1 specimen of *Crataegus* from Indiana. (Given by Mr. F. D. Kern.)

50 specimens "Musci Frond. Archipelagi Indici et Polynesiaci." (Distributed by Prof. Max Fleischer.)

PLANTS AND SEEDS.

27 plants for the conservatories from Montserrat. (Collected by Dr. J. A. Shafer.)

1 plant of bamboo for the conservatories from China. (By exchange with Buffalo Botanic Garden.)

300 packets of seeds. (By exchange with the Botanical Garden, Bonn, Germany.)

80 packets of seeds. (By exchange with the Warley Place Garden, Great Warley, England.)

7 packets of seeds. (By exchange with the Botanical Garden, Lund, Sweden.)

138 packets of seeds. (By exchange with the Botanical Garden, Hamburg, Germany.)

18 packets of seeds. (By exchange with the Botanical Garden, Mt. Holyoke College, South Hadley, Mass.)

12 packets of seeds. (By exchange with the Botanical Garden, University of Catania, Italy.)

4 packets of seeds from the Platte River, Nebraska. (By exchange with Prof. C. E. Bessey.)

10 packets of seeds from Costa Rica. (Given by Mr. C. Wercklé.)

Photographed by Mr. F. C. Berte.

MEMBERS OF THE BOTANICAL SOCIETY OF AMERICA AND THEIR GUESTS AT THE NEW YORK BOTANICAL GARDEN.

JOURNAL

OF

The New York Botanical Garden

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NEED OF ADDITIONAL FUNDS.

(Statement authorized by Board of Managers May 9, 1907.)

As the development of the Garden as a great educational institution proceeds, the need of additional funds to supplement its ordinary income in order to properly expand its work becomes apparent. The Board of Managers now hold three such funds, as follows:

1. A bequest of the late Ex-Chief Justice Charles P. Daly, in memory of Mrs. Daly's grandfather, David Lydig, known as the David Lydig Fund, amounting to \$34,149.86, and yielding about \$1,365 annual income. By resolution of the Board this annual income is devoted to publication and is of great assistance and value.

2. A gift by the Misses Olivia E. and Caroline Phelps Stokes of \$3,000, as a fund for the preservation of native plants, yielding \$120 annual income, which is devoted to lectures and literature, advocating the purposes for which the Fund was established.

3. Fees paid to the Garden by students registering for special privileges are credited to the Students' Research Fund, which now amounts to about \$2,700, and yields about \$108 annual income, grants from which are made to aid the investigations of especially meritorious students when required.

Foundations for other objects are greatly desired, and it is believed they would add much to knowledge. They may bear, in general, such personal designations as donors may desire to indicate.

1. *Exploration Fund.* The obtaining of plants and of specimens of their products from distant regions little known botanically for public display and for expert study, is one of the most important duties of the Garden; a fund not less than $250,000, yielding $10,000 or $12,000 annually, is needed.

2. *Horticultural Fun l.*—In order to develop horticultural work, to promptly secure and exhibit all horticultural novelties, to investigate horticultural problems, to establish and maintain decorative plantations, a fund not less than $100,000 is needed to yield at least $4,000 or $5,000 annually.

3. *Library Fund.* The Library has been built up by gifts from friends of the Garden and is now a noteworthy collection of botanical and horticultural literature. To render it more complete and to permit the purchase of all books published on botany and horticulture, a fund of $50,000, yielding about $2,000 a year, is required.

4. *Conservatory Fund.* For the purchase of rare, large, or otherwise interesting and valuable plants for the public conservatories whenever offered by dealers or collectors,a fund of $50,000 is required, to yield about $2,000 annually.

5. *Herbarium Fund.* The herbarium is the most important of the permanent scientific collections of the Garden, because it provides the necessary means for determining the names, features and relationships of plants. It should be continually increased by the purchase of specimens from collectors all over the world, and a fund of $50,000, to yield about $2,000 a year, should be provided for this purpose.

6. *The Lecture Fund.* Public lectures on botanical and horticultural topics are important educational factors, and the lecture hall in the Museum Building is provided for this purpose. Money for the preparation of illustrations and the payment of lecturers additional to members of the curatorial staff of the Garden is needed, in order that at least one public lecture a week throughout the year may be delivered. A fund of $25,000, to yield about $1,000 a year, would accomplish this.

7. *Illustration of the "North American Flora."* It is very desirable that illustrations in color of native North American plants

accompanied by descriptive letter press should be published, and the collections at the Garden furnish the specimens needed. The preparation of drawings, their reproduction, and the printing and editing of such a work would need a fund of about $30,000, to yield $1,200 to $1,500 annually. The total cost of issuing sixty to seventy-five plates a year would be about $4,000, but more than half of this cost would be met by subscriptions to the work, and in time they might defray the entire cost.

8. *Scholarship Funds.* For the support of trained deserving students while investigating botanical and horticultural problems. Several such funds from $10,000 to $25,000, yielding $400 to $1,200 annually, could be operated with signal advantage to science.

9. *Laboratory Fund.* For the purchase of apparatus and other materials for the laboratories provided in the Museum Building. The laboratories are most important adjuncts to investigation and they should be well supplied with all necessary equipment; a fund of $20,000 to yield $800 to $1,000 a year is needed.

10. *Fund for Horticultural Prizes.* In order to stimulate the production and exhibition of horticultural novelties, it is desirable that the Garden have a fund of $10,000, to yield $400 or $500 a year for the recognition of such work by experimenters in any part of the world, the prizes to be in money or as medals.

11. *Fund for Botanical Prizes.* In order to stimulate scientific botanical discovery, the power to recognize original observations and other noteworthy contributions to botanical knowledge, by prizes, either in money or as medals, a fund of $10,000 should be provided to yield $400 to $500 annually.

12. *Research Funds.* Several funds from $5,000 to $50,000 yielding from $200 to $2,500 annual income are desired, to be devoted to the solution of unsolved botanical or horticultural problems.

It is also very desirable that the general Endowment Fund of the Garden be increased. The present endowment has been contributed as follows:

Columbia University	$25,000.00
J. Pierpont Morgan	25,000.00
Andrew Carnegie	25,000.00
Cornelius Vanderbilt	25,000.00
John D. Rockefeller	25,000.00
D. O. Mills	25,000.00
Hon. Addison Brown	25,000.00
William E. Dodge	10,000.00
James A. Scrymser	10,000.00
William C. Schermerhorn	10,000.00
Mrs. Esther Herrman	10,000.00
Hon. Charles P. Daly	5,000.00
Oswald Ottendorfer	5,000.00
Samuel Sloan	5,000.00
George J. Gould	5,000.00
Helen M. Gould	5,000.00
John S. Kennedy	5,000.00
William Rockefeller	5,000.00
Arnold, Constable & Co.	5,000.00
Mrs. Antoinette Eno Wood	5,000.00
Mrs. George Whitfield Collard, in memory of the late Josiah M. Fiske	5,000.00
Morris K. Jesup	2,500.00
Mrs. Melissa P. Dodge	1,000.00
C. P. Huntington	1,000.00
Tiffany & Company	1,000.00
David B. Ivison	1,000.00
Hon. Seth Low	1,000.00
Samuel Thorne	1,000.00
H. C. von Post	1,000.00
Mrs. Percy R. Pyne	1,000.00
Fred F. Thompson	1,000.00
John Innes Kane	1,000.00
Mrs. Frank Ferguson and Mrs. W. G. Nichols, in memory of their father, the late H. O. Armour	1,000.00
M. F. Plant	1,000.00
James B. Ford	1,000.00
Francis Lynde Stetson	1,000.00
Hugh N. Camp	250.00
Smaller contributions	160.00
Life Membership Fees	18,750.00
Total	$300,660.00

In preparing a habitation for the Botanical Garden, the city has expended over $1,250,000 upon its buildings, grounds, and roads, and it contributes also to their maintenance as a part of the park system, for the health, instruction and enjoyment of the people; but for support of the life and soul of the Garden, as a valuable and progressive scientific institution, we must look mainly to the public-spirited citizens of New York. Much has been already done, as a glance at its work will show. The Directors have expended nearly $300,000 of privately contributed funds and have invested a fund of about $335,000, similarly derived as already stated; and in gifts of plants, books, apparatus and the deposit of collections, have received about $225,000 more, making a total of about $860,000 contributed by individuals.

The Garden has won an honored and a world-wide name for what it has so far done, but it must have means for progress.

Will you not help in this endowment for educational and scientific work? Remittances may be made to either of the undersigned.

C. F. Cox,
Treasurer,
Grand Central Station.

N. L. Britton,
Director-in-Chief,
N. Y. Botanical Garden.

In behalf of the Board of Managers of the New York Botanical Garden,

Addison Brown,
Chairman of the Executive Committee.

EARLY EUROPEAN BOTANISTS IN JAPAN.

For our first knowledge of the rich botanical treasures of Japan, we are indebted to commerce and the Dutch East India Company. With the exception of a few years (1613–1623) in the early part of the seventeenth century when the English had a small trading-post in Japan, the country was closed to all foreign nations except the Portuguese, the Dutch and the Chinese. In 1640 the Portuguese were expelled and until the middle of the last century, entrance was denied to all except the Dutch and the Chinese.

Three illustrious names, Kaempfer, Thunberg and Siebold, head the list of European workers upon the flora of Japan. It is interesting to note that each of these men went out in the employ of the Dutch East India Company; that each made the difficult journey from Desima to Yedo in order to accompany the Dutch Ambassador on his annual visit to the Court of the Emperor; that the vocation of each was that of the physician while botany was but an avocation. Each on his return to his native land wrote long and informally of his impressions of Japan, and these works are invaluable in that they picture the conditions that obtained in Japan before her ports were opened to the nations; each also produced a botanical work of permanent value — works that persist as corner-stones in the foundations of Japanese botany.

Engelbert Kaempfer (1651–1716) was a native of Lemgow in Westphalia and was educated at the universities of Cracow in Poland and Königsberg in Prussia. He spent much time in the study of "Physick and the Natural Sciences" and so paved the way for the useful observations and discoveries which he afterwards made in his travels. From Prussia he went to Sweden, where his scholarly attainments brought him into great repute at the University of Upsala and advantageous offers were made to him. This was a score of years before the birth of Linnaeus. There is a tendency to forget that botany did not begin with Linnaeus, who is often called the "father of modern botany." He may be the "father," but if the ancestry should be followed up, the grandfathers and great-grandfathers of modern botany would form a most respectable family-tree.

Kaempfer, however, preferred foreign travel and accepted an appointment as secretary of the embassy which the Court of Sweden was then sending to Persia. Three years later, the negotiations with the Persian Court were concluded and Dr. Kaempfer entered the service of the Dutch East India Company as Chief Surgeon to the Fleet. After touching at various points on the shores of Persia and Arabia, the coasts of Malabar, the islands of Ceylon, Sumatra and Java, he arrived in Japan in the autumn of the year 1690. His experiences in that country are most delightfully told in the thousand pages of his *History of Japan.* In these volumes there is the fascination that comes from telling a thing for the first time when every detail is new, and there is the added charm of the beautiful country with its conservative and art-loving people.

The first settlement of the Dutch had been on the Island of Firando, but in the year 1638 they were commanded by the Emperor to demolish their factory and warehouse, and this for no other reason, says Kaempfer, than that "they were of hewn stones handsomer than the buildings of the country and because the year of our blessed Saviour's nativity was engraved in the front." With this unexpected order they were obliged to comply, "not only without showing the least mark of dislike but even with seeming satisfaction"! Soon after the expulsion of the Portuguese, the Dutch were ordered to their abandoned site on the little island of Desima in the harbor of Nagasaki. Kaempfer gives a lucid description of this island or "prison" as he calls it. "In shape it nearly resembles a fan without a handle, being of an oblong square figure, the two longer sides whereof are the segments of a circle. It is joined to the town by a small stone bridge at the end whereof is a strong guard-house where there are soldiers constantly upon duty. Just before the bridge towards the town is a place built of square stones where they put up the Imperial Mandates and Proclamations and the Orders of the Governors. Two orders of the Governors are continually to be seen there on so many boards; one of these relates to the regulation of the Guard, and the other is directed to the street-officers of Desima, and to all persons who have any business there and are on this account obliged to go in or out."

Once a year the Dutch ships put into harbor and the men were allowed to remain on the island for the two or three months of their stay. Then the director with a small number of men, only seven in the time of Kaempfer, remained on the island, where at all times they were watched by guards and inspectors. That there might be no occasion for the Dutch to acquire the Japanese language, the government insisted upon a body of one hundred and fifty interpreters.

Once or twice a year, the few Dutchmen who remained were permitted to take a walk into the adjacent country, particularly to view the temples. This privilege was more frequently granted to physicians and surgeons under pretense of going to search for medicinal plants. But it was a somewhat expensive luxury as a great retinue must accompany all such expeditions and be treated to a dinner, and one must "see his purse strongly squeezed for the most common civilities."

After the departure of the ships, the director of the company with a numerous suite set out on a journey to the court of the Emperor to make the usual yearly presents. This was a great undertaking, for the way was long and tedious, "three hundred and twenty-three Japanese leagues of different lengths," nearly a thousand miles by land and sea. Kaempfer says that upon the journey they were "allowed no more liberty than even close prisoners could reasonably claim. We were not suffered to speak to anybody, not even without special leave to the domesticks and servants of the inns we lodged at. As soon as we came to an inn, we were without delay carried upstairs, if possible, or into the back apartments which have no other view but into the yard which for a still greater security is immediately shut and nailed up."

One wonders how with so many restrictions Kaempfer was able to botanize by the way. But he says that in addition to the various things that travelers usually carry along on their journeys, he had for his own use a large Javan box in which he "privately kept a mariner's compass, in order to measure the directions of the roads, mountains and coasts; but openly and exposed to everybody's view was an ink-horn, and I usually filled it with plants, flowers and branches of trees, which I figured and described. Doing this, as I did it free and unhindered to everybody's knowledge, I should be wrongly accused to have done anything which might have proved disadvantageous to the Company's trade, or to have thrown any ill-suspicion upon our conduct from so jealous and circumspect a nation. Nay, far from it, I must own that from the very first day of our setting out till our return to Nagasaki, all the Japanese companions of our voyage and particularly the Commander-in-chief were extreamly forward to communicate to me what uncommon plants they met with, together with their true names, characters and uses which they diligently inquired into among the natives. The Japanese, a very reasonable and sensible people, and themselves great lovers of plants, look upon Botany as a study both useful and innocent, which pursuant to the very dictates of reason and the laws of Nature, ought to be encouraged by everybody." Still Kaempfer confesses that at the very beginning of the journey he took whatever means he could to secure the friendship and assistance of his fellow-travelers "obliging some with a submissive humble conduct and ready assistance as to physic and physical advice; others with secret rewards for the very meanest services and favors received from them."

Had it not been for this adroitness and tact and skill in overcoming the prejudice of the Japanese, it is doubtful if much could have been accomplished. The pioneer botanist in Japan must needs be a diplomatist as well as a botanist. Many of the interesting facts thus obtained are embodied in a chapter of his history under the heading "Plants of the Country." This relates more particularly to those of agricultural or economic value while the *Amoenitates Exoticae* contains a catalogue of all plants noted in his travels with "descriptions more accurate and botanical."

He tells us of the kus or "Camphire-tree" and the preparation of "camphire"; of the urusi or "Varnish-tree which affords a milky juice, which the Japanese make use of to varnish, or as we call it, to japan all their household goods, dishes and plates of wood, and this from the Emperor down to the meanest peasant"; of the "Tsianoki or Tea-shrub which is allowed no other room but round the borders of Rice and Corn-fields, and in other barren places unfit for the culture of other things; the common drink of the Japanese is brewed from the larger leaves of this shrub; but the young and tender leaves dried, powdered and mixed in a cup of hot water into a sort of Soup are drank in houses of people of quality."

He says that "Japan may vie with most, if not all, known countries for the great variety of beautiful Plants and Flowers wherewith kind Nature hath most liberally and curiously adorned its hills, fields, woods and forests. Some of these the Japanese have transplanted into gardens and improved by assiduity and culture to the utmost, and indeed to a surprising degree of perfection. . . . There are numberless varieties of Feverfews and

Lillies growing in this country. The first are the chief ornament of the houses and gardens, the others of desert and uncultivated places. Nor hath Nature been less kind with regard to the Narcissus, Flowers de Lys, Clove-Gilli-Flowers and the like. But these several flowers fall as short as others of their kind, growing in other countries, in strength and agreeableness of smell, as they exceed them in the beauty of their colors. The same holds true with regard to most fruits of Japan which are far from coming up to the pleasant aromatic tastes of those which grow in China and the Eastern countries. . . . Numberless plants grow in the fields, upon hills and mountains, in woods and forests, in morassy grounds, in barren and uncultivated places, along the Sea-coasts and in short, everywhere. Of all these, there are but few but what afford their roots, leaves, flowers and fruits for the sustenance of the people. . . . There is a great variety of mushrooms, most of which are eat. . . . Of all the soft submarine plants, there is hardly one but what the Natives eat. Fishermen's wives wash and sell them and are very dextrous in diving them up from the bottom of the sea in twenty to forty fathom depth."

In the appendix, there are some delightful papers on "The Natural History of the Japanese Tea-plant," "The Making of Japanese Paper" and "An account of the Moxa, an excellent caustic, with a scheme showing what parts of the human body are to be burnt with that Plant in several Distempers."

After eight years abroad, Kaempfer returned to his native town intending to practice medicine and publish his travels and scientific observations at leisure, but his success as a physician so consumed his time and energy that only the *Amoenitates* was published in his lifetime. To Sir Hans Sloane, who purchased all his unpublished manuscripts, is due the publication of his "*History of Japan*," which was translated into English from the original High German by Scheuzer. From this English translation it was later rendered into French, then into Dutch and finally (1777) again into German.

We hear of no further botanical work in Japan until Linnaeus had nearly attained his allotted three score and ten years. Then it was that the young Swede, Carl Peter Thunberg (1743–1778), his pupil in botany and a graduate of the medical department of the University of Upsala, became interested in the botany of Japan. At Amsterdam he had repeatedly heard regret expressed by the professors and botanists of the botanical garden that so little was known of the rich flora of Japan. This suggested to him the idea of visiting that country. Through the instrumentality of influential friends he soon secured an appointment as surgeon on board a vessel of the Dutch East India Company and proceeded to Japan by way of the Cape of Good Hope and the island of Java. His *Voyages au Japon* published in French are as quaintly interesting as the "History" of Kaempfer, and his experiences were strangely similar. The condition of the Dutch settlement showed no change and restrictions were perhaps more severe than ever. We cannot improve on his own way of telling his own story:

"My first care on landing was to provide myself with interpreters and to secure the favor of the officers who frequented our little island (Desima). My knowledge of medicine gave me more than one opportunity to be of service to them as well as to their sick relatives and friends. In short my frank and open manners won their confidence. I was not likely to inspire with much uneasiness the inspectors of commerce who could very well see that all my attention was focussed on medicine and botany. . . .

"I was so fortunate as to discover in the wild plants of the country some valuable medicinal properties and took advantage of these discoveries for the purpose of obtaining a permit which had never been granted to any European, to explore the region about Nagasaki in order to collect plants and seeds. I succeeded beyond my expectations, but almost immediately the favor was recalled.

"Before granting the permit, the Governor, fearing some innovation, had caused search to be made throughout the records of the country to ascertain if such a concession had ever been made to a European surgeon. He discovered that at some time considerably remote, during an extremely fatal epidemic when the ship's remedies had become exhausted, that a Dutch surgeon had been allowed to land and search the environs of Nagasaki for medicinal herbs. This discovery had the effect of immediately raising all scruples. But unfortunately the Governor examined the case a second time and found that the Dutchman had been of the rank of Second Surgeon while I was a First Surgeon. Therefore was I in no way entitled to the same privilege and it was promptly withdrawn!

"A circumstance of this kind is of tremendous importance in the eyes of the Japanese who are conservative to an inconceivable degree. They pride themselves upon the strict execution of the wishes of their sovereign without troubling themselves to interpret them or to make the slightest concession to circumstances. As for myself, while I was in no way regardless of the counter-order, still I was more determined than ever. I attempted to convince the superior officer that there was really no marked difference between a First and a Second Surgeon; that the First Surgeon had passed through the lower rank of the Second, and that the Second had the right to aspire to the rank of the First! These observations so wise met with approval and were sufficient to raise the last scruple of the Governor who once more rendered me the permit, but so late that I was unable to profit by it before the month of February. It was with great regret that I had spent the entire autumn waiting for that miserable revocation."

In the meanwhile, however, Thunberg's ingenuity had helped him out. He goes on to tell us that "Fortunately several of the interpreters had become my pupils in medicine and surgery. Under my supervision, they treated the sick of the village. As remuneration for my lessons, I demanded of them all the plants, flowers and seeds which they could collect in the neighborhood of Nagasaki."

On the fifteenth of August, they landed the animals from the ship. Cows, calves, sheep, pigs and deer were brought every year from Batavia, not only for the consumption of the Europeans at the factory, but also for the provision of the vessel on its return voyage. These animals were kept in a stable upon the island and during the winter fed upon rice, rice-straw and the young branches of trees; at other seasons on such leaves and herbage as the native servants were able to gather from the neighboring mainland. "Never once," says Thunberg, "did I forget to examine the fodder which was brought regularly twice a day, and thus it was that I found some very rare plants, some of which I judged worthy to figure in the herbaria of Europe." Then he adds plaintively, "These discoveries only served to render more exasperating the species of captivity which bound all Europeans to the narrow and desolate island of Desima."

On the seventh of February, after the final grant of the long-delayed permit, Thunberg made his first botanical excursion into the environs of Nagasaki. To the modern botanist who clambers about with only his tin box for company, this seems like a formal and imposing occasion. He was obliged to take a numerous retinue of interpreters first, and interpreters second, of *banjos* of different grades, of *compradores*, and a multitude of *employes*. This numerous suite was as hungry as in the days of Kaempfer and "occasioned considerable expense in the way of refreshment whenever the route led by an inn." "Yet," Thunberg adds, "I had not the *complaisance* to limit them, and it was necessary that they should accompany me over the hills and through the mountains."

These excursions were made once and sometimes twice a week until the time of the departure of the Dutch Ambassador whom Thunberg accompanied to the court of the Emperor. This journey was a repetition of those of Kaempfer's experience, and although Thunberg does not tell us how he did his botanizing, we know from his *Flora Japonica* that it was not neglected. The mountains of Fakonia and other places along the route and Yedo are constantly quoted as the localities of plants which he describes. This work published in 1784 contains descriptions of about one thousand species, and is marvellously accurate and complete when one considers the circumstances under which the material for it was collected. On his return to Sweden, Thunberg was made Demonstrator of Botany at the University of Upsala, and in 1784 was appointed Professor of Botany and occupied the chair left vacant by Linnaeus until his death (1828).

He published several important works and numerous memoirs in the transactions of many Swedish and foreign societies, in fifty-six of which he held an honorary membership. Fifteen years before his death, he received the title of Commander of the Order of Wasa, and one likes to think of him as Sir Carl Peter Thunberg, distinguished botanist, traveler, gentleman, a man "sweet and amiable and who enjoyed general esteem."

Philip Franz von Siebold was the last of the great European botanists to visit Japan in the days before the awakening. He was a member of an illustrious German family celebrated for its learning and scientific knowledge. His grandfather was an eminent physician; his younger brother Carl Theodor Ernst has been called the "Nestor of German Zoology." With a view to improving the trading relations of the Dutch, he was sent out by the East India Company. He went out not only to act as their physician and to plan improvements in the sanitary conditions of their island prison, but also as a man of science with a determination to further its progress in every possible way.

Well equipped with scientific apparatus he arrived in Desima in 1822 and for six years made the island his headquarters. Already conditions for scientific work had improved to a considerable degree and he had comparatively free access to the country, while his reputation as a physician and scholar, brought him many visitors from all parts of Japan. Some of these became his ardent students. His valuable stores of information were constantly increased by trained natives whom he sent to collect for him in the interior. In 1826 he accompanied the Dutch Ambassador to Yedo and was allowed to remain behind, the only foreigner in the city. Unfortunately, however, his zeal in scientific pursuits outran his discretion, and for getting possession of a native map of the country, he was imprisoned and finally compelled to leave Japan.

On his return to Germany, he published not only those works on the fauna and flora and natural history of Japan that for a half-century made him the first authority on those subjects, but he wrote also upon the history, language and literature of the country. His most important work from the latter standpoint is

Nippon: Archiv zur Beschriebung von Japan, which first appeared in five quarto volumes of text and six folio volumes of atlas and engravings. In 1897 his illustrious son, the Baron Alexander von Siebold, revised this work, the edition appearing in two large attractive volumes with many illustrations and printed in German. As we have already noted the corresponding work of Kaempfer is available in the quaint English of the early eighteenth

Fig. 15. Monument to Kaempfer and Thunberg erected by Siebold on the island of Desima.

century, while that of the Swedish Thunberg is in French. The scientific descriptions of all are in Latin.

In 1859 Siebold undertook a second journey to Japan and was invited by the Emperor to his Court. With the consent of his own government, he entered the Japanese service as negotiator between Japan and the powers of Europe, but his services were of short duration, for various intrigues combined to compel him to retire from his post and ultimately from the country. To his son, Baron Alexander, fell the honor of moving in those ever-widening diplomatic circles that were instrumental in rendering Japan accessible to the ideas of the West.

The name of Siebold is connected with the introduction of many rare and beautiful plants into the Gardens of Europe, more particularly, Japanese lilies, camellias, and chrysanthemums. His herbarium of the plants of Japan contained about two thousand species and twelve thousand numbers. The types of the *Flora Japonica* are now in the Herbarium of the Imperial Academy of St. Petersburg: Thunberg's Japanese types are in the Delessert Collection at Geneva; Kaempfer's plants of Japan and his manuscripts are preserved in the British Museum.

Siebold's *Flora Japonica* consists of three large folios containing colored plates of numerous rare and curious plants. On the title-page we find a tangible record, here reproduced, of the monument to Kaempfer and Thunberg which, at his own expense, Siebold erected to their memory on the island of Desima. In the *Leben und Wirken von Philip Franz Siebold* by his son, it is with singular satisfaction that we read that his surviving students and the nobles and statesmen of Japan have erected a monument in Nagasaki in honor of the man who, according to the closing lines of the inscription, deserves the first place among the men, "welche Kenner und Vertreter der europäischen Wissenschaft waren; folglich ruht der Ruhm der grossen That, der Einfuhrung der Civilisation im heutigen Japan, auf Siebold, dessen Andenken dieser Stein gewidmet ist."

MARY PERLE ANDERSON.

WHY IS A SUBSTANCE POISON?

The study of poisons and their influence upon living organisms has always been prominent in animal and plant physiology. The reason for this is, that since poisons more or less disturb the so-called vital processes and tend to change the behavior of an organism, the belief has prevailed that the study of poisons and of poisoning will bring us nearer to a solution of the mystery of life itself.

The word poison ordinarily suggests "skull and cross-bones," but the term is rather elastic in meaning so that it is possible for the same substance to be a food in some cases and a fatal poison in others according to the concentration and conditions. A poison may accelerate the vital processes, may retard them, or it may stop them.

It is now firmly believed that the so-called vital processes are chemical reactions largely. The digestion of starch to sugar which occurs in plants and animals is a chemical reaction. Each advance in chemistry and physics offers a new basis for an advance in physiology so that now considerable attention is being paid to the separate vital processes as chemical reactions rather than to the activity of the organism as a whole, which is of course much more complicated. Gradually more and more of the vital processes can be carried on in test tubes, so to speak, and the real nature of poisoning will probably be discovered by an understanding of the conditions prevailing when a poison affects a single chemical reaction. Thus the effect of poisons upon the digestion of starch and upon the digestion of protein have been studied.

We may think of a chemical reaction between two substances as a rearrangement of the matter composing those substances which results in the formation of a third substance different from the original ones. A poison, then, is a foreign body whose presence alters the rate of reaction between two others. Modern research has shown that any third substance more or less alters the rate of a given reaction. In this sense every substance may under some conditions be a poison. To understand why a substance is poison apparently involves a knowledge of why any third body has an influence, great or small as it may be. Any number of hypothetical questions might be asked here but it is evident that the fundamental nature of matter and the properties of its ultimate constituents are involved.

Before modern research had revealed the important part taken by electrical energy in chemical changes numerous attempts were made to correlate the poisoning capacity of the elements with their physical and chemical properties as then known. Thus compounds containing the heavy metals, mercury, copper, lead, etc., were found to be more poison than those containing the lighter metals such as sodium, calcium, etc. In all those efforts the exceptions encountered were so numerous as to make a satisfactory explanation impossible.

According to the modern view chemical action is largely an affair between small particles called ions. Each ion carries an electrical charge. Some ions carry a negative charge and others carry a positive one. Some ions hold their charges much more tenaciously than others. When an ion loses its charge or gains an additional one it suffers a change and likewise the ion from which it gained the charge or to which it lost one. Now we may think of a living organism as an association of ions between the members of which there is a constant interchange of electricity. This interchange is outwardly manifest as the so-called vital processes. As long as the interchange remains in natural equilibrium the organism lives, but when this equilibrium is disturbed the organism is poisoned and death is a matter of the degree of the disturbance. Suppose a foreign substance, an ion of mercury, for example, approaches this association of ions (our living organism) and comes within the sphere of influence. It is an experimental fact that the mercury ion does not hold its charge very firmly, so that some ion member of our association steals the charge carried by the mercury ion. The electrical equilibrium previously existing in the organism is thus disturbed by the additional charge and perhaps a total readjustment of the electrical relations occurs — the organism is poisoned. Now suppose some other ion instead of the mercury, for example a sodium ion, reaches the sphere of influence of our organism. Since the sodium ion holds its charge too firmly to lose it, the chemical relations of the organism remain undisturbed — the sodium is not poison. This is essentially the latest theory of the real nature of poisoning. Those substances are most poison which hold their charges least firmly. This theory was advanced in 1904 and has been supported by two subsequent investigations by different men.

During the past six months a test of the theory has been made in the laboratory of the Garden. The digestion of fat was selected as the chemical reaction upon which the effect of a series of poisonous metals was tried. This reaction had never been tested and it proved to be more favorable for the purpose than others so far tried because the sources of error are much less. The results invalidate the theory. The poisoning power of the metals tried did not bear a definite relation to the energy required to separate a charge from its ion. The results also strengthen the view that a general law formulating the particular nature of poisoning and applicable in all cases, cannot be found. It does seem probable, however, that an explanation can be had why of two substances affecting a reaction one is more potent than the other. This would be a forward step, and our results have suggested a promising clue.

RAYMOND H. POND.

SOME FEATURES OF THE MOUNTAIN FLORA OF THE PHILIPPINES.

When one thinks of the Philippines and their vegetation, the first idea is that of a purely tropical flora, and until comparatively recently there was nothing in botanical publications and there is to-day practically nothing in current literature to contradict such an impression. And yet, even had no direct evidence been obtained of the presence of a very different element, a little reflection should lead us to expect something of the kind. Between the extreme northern and southern islands there is a difference in latitude of over sixteen degrees, about the distance which separates New York from northern Labrador or from the central Bahama Islands; though as the Philippines are entirely within the tropics, the resulting changes there should be less pronounced than in regions farther from the equator. But there is another element of still greater importance to be considered, altitudinal variation. The Philippines contain a great many hills, although none are so high as some in Formosa on the north or Borneo on the southwest. The highest are in Mindanao, the most southerly of the large islands, but the greatest mass is in Luzon, at once the largest and the last island of importance to the north. Nearly its whole northern half is mountainous, and the conjunction of northern latitude and high elevation has permitted a very different flora from that of lower levels. The higher peaks farther to the south show the same tendency, but not so noticeably. Naturally, the lower-lying and therefore the warmer portions of the islands are the better known.

Until a generation ago, botanical information regarding the Philippines had been obtained either by expeditions which spent a comparatively short time in the islands, or by resident Spaniards, and much of the work of the latter was unreliable. Both explored the country around Manila, and most of the visitors penetrated at least as far into the country as the great lake of Laguna de Bay, and climbed some of the hills in its rear. Another somewhat frequent stop was at Zamboanga, in Mindanao; but attention was almost confined to Luzon. A much more strenuous collector was Hugh Cuming, who spent several years there gathering shells, plants and birds, and in so doing seems to have visited nearly all of the principal islands. There is strong internal evidence that he never reached very high levels on any of the mountains, and was not beyond the edge of the hills of northern Luzon. The difficulties were not all physical. The Spanish hold upon the wilder portions of the group was so slight that no collecting could be done in any such place until a comparatively short time ago.

About twenty years before the American occupation, Sebastian Vidal, director of the Forestry Bureau, took the initiative in the exploration of Benguet, which is the province forming the southwestern portion of the mountain region above mentioned, and more recently Loher penetrated into Lepanto-Bontoc, adjoining Benguet on the north.

A few of the species which to us most strongly suggest temperate conditions were known before their day. Oaks were described by Blanco in 1837, and several kinds are now known; the first pine was described in 1847, having been collected by Cuming a few years before. Some beautiful orchids sent to England by him had brought collectors representing many of the leading horticultural firms of Europe to the islands, and one of them, Wallis, discovered the beautiful white Philippine lily, *Lilium philippinense*, now frequently cultivated, which is very abundant in the pine forests of Benguet, the most southern home for any species of this genus.

It has remained for the new régime to disclose more fully the nature of this northern flora, and to greatly augment the number of species known from the Philippines by the exploration of many other districts as well, including the three highest mountains in the archipelago, Apo and Malindang in Mindanao, and Halcon in Mindoro. At least a thousand species new to science have been found, and already about three fourths of this number have been published.

Perhaps we can most vividly realize the character of much of this hill vegetation by glancing at the names of some of the plants which compose it, remembering that while many of them are found only at the highest altitudes, others occur lower down upon the slopes. There are several species of raspberries, blueberries, sedges, rhododendrons, and violets; fewer species represent the rushes, everlastings, gentians, hollies, cresses, willow-herbs, loosestrifes, bayberries, wintergreens, barberries, clematis, and honeysuckles; and there is probably only one kind each of buttercup, rose, meadow-rue, thistle, sow-thistle, St. John's-wort, anemone, chickweed, stone-crop, eyebright, bedstraw, lobelia, aster, wild lettuce, golden-rod, strawberry, ash, maple, and willow.

Even these familiar names show very inadequately how different is the general aspect of the highlands from that of the lowlands, which is undoubtedly tropical.

It is among such species that we find those that show the most important connecting links with the flora of other countries. Thus, *Boenninghausenia albiflora* Reichb. f., a plant closely related to the rue, and previously known from the Himalayas and the mountains of western China and Japan, has been collected in Benguet by Mr. Williams and others. *Thesium psilotoides* was originally described by Hance from a few specimens found near Canton, in China. Mr. Williams found it also in Benguet, and it has since been collected farther north by Mr. Merrill. *Anaphalis adnata* DC. and *A. contorta* Hook. f., natives of the mountains of India and southern China are now also known from Luzon.

Ten times as many similar cases might be quoted, and instances where the species are closely allied but not identical are still more numerous. These throw a great deal of light both upon the earlier geological history of the islands and the origin of their flora. It is evident from the foregoing that Luzon was connected with continental Asia since these species were evolved, but yet long enough ago to permit the differentiation that has taken place in a very large number of other cases.

Still more noteworthy, perhaps, is the presence of a distinct, though much smaller, Australian element, first noted over twenty years ago by Mr. Rolfe and recently emphasized by Mr. Merrill, and it is again significant that these species are mainly from the mountains.

The oddly-shaped island of Celebes, lying to the south of the Philippines, shows many points of floristic similarity with them, and especially with the nearest large island, Mindanao; but the cases known at present seem of less interest.

A Bornean element is also known to exist, but investigations in this direction are least developed. It is certain to be very pronounced, if for no other reason than that the geographical limit between the two areas is ill-defined. Important explorations have recently been carried on in the large connecting islands of Mindoro and Palawan, but the results are not yet available.

The indications are, however, that much the greatest number of connecting links will be found to be with Formosa, as would be expected from its geographical position and general resemblance to the northern Philippines. Its flora, as recently worked out by Professors Matsamura and Hayata, already makes this evident, and, as little collecting has yet been done at elevations above 2,000 feet, many discoveries of the greatest interest are still to be expected; it is among these that we would look for the greatest number of plants belonging also to other countries.

From another point of view, the climate indicated by this semi-temperate vegetation in the north of the islands suggests most important possibilities for their future. Advantage has already been taken of this more bracing temperature from the standpoint of health. Much of the land, in Benguet at least, is known to be very fertile, and is already under high cultivation, and the rapid improvement in conditions farther north and fuller investigations thus made possible will soon make known the agricultural capabilities of that part of the region as well.

C. B. Robinson.

THE ECONOMIC GARDEN.

Ever since the New York Botanical Garden was opened to the public, the need of an economic plot, where visitors, especially the younger and city-bred ones, might see the principal hardy useful plants in a growing state, has been keenly appreciated, but not until the present year have the conditions been favorable for its establishment. Late in the summer of last year, a plot of half an acre, lying just north of the Morphological Garden, was set apart for this purpose. This plot, to be known as the Economic Garden, occupies the upper or northern end of a valley which lies to the eastward of the large conservatories. The southern half of this valley is occupied by the Hardy Herbaceous Garden, the three gardens together rendering this valley one of the most beautiful and interesting horticultural sites in the vicinity of New York. The valley, at the site of the Economic Garden, is only about fifty yards wide. An old drain which ran through the center has been converted into a rivulet, connecting a chain of small pools, from which the meadow slopes up to a rocky ridge on either side. Both of these ridges are occupied by a sparse natural forest growth. The margins of the slopes have been planted with the more important useful trees and shrubs, foods being represented upon the western side, and medicines, tanning and dye products, etc., upon the eastern side. The open meadow is laid out in beds, planned upon the unit system, where herbaceous plants may be found, their separation corresponding with that of the woody plants. The units are classified, so far as practicable, upon an economic basis. The growing collections represent one or more varieties of many of the plants cultivated for their material uses which will endure our climate. Besides these, a large number of the plants used by the aborigines, especially food plants, are represented. In the rivulet and the pools, many aquatics and marsh plants, such as calamus, cat-tail, rice, both cultivated and wild, taro, and wappatoo have been planted.

It is expected that this garden will become a very popular feature in the grounds, after its plants have become well established. It is notoriously true that many of our city people, even adults, have no idea of the character and appearance of the plants from which our most important vegetable products are derived. Aside from this fact, people of much more pretentious knowledge will be likely to find here subjects of novelty and even of surprise. The economic garden, moreover, is expected to furnish much new or complementary material to the Economic Museum. It is planned to form an economic department in the new series of glass houses soon to be built, which will complete our present economic series of exhibits.

H. H. Rusby.

A NEW FLOWER GARDEN ADJOINING THE CONSERVATORIES.

To the north of the Conservatories, between the terrace and the opposite ridge on which the pines are located, is a flat area lying between the paths, about five hundred and fifty feet long and fifty-six feet wide, divided into five rectangular plots. This tract has been retained in green sward until very recently, but it was decided this spring to plant the two largest of the five plots with flowers and shrubs.

Each of the two plots referred to is about one hundred and seventy-six feet long and fifty-six feet wide, making a total in the two plots of about 19,712 square feet. It seemed desirable to so arrange the planting as to make it attractive during both winter and summer. This was of easy accomplishment so far as the summer was concerned, and to insure this for the winter it was decided to plant large masses of conifers and broad-leaved evergreens in the center, allowing them to run out here and there in small masses. Between the irregular margin thus produced and the surrounding border, measuring ten and one half feet wide, have been planted deciduous shrubs in masses.

The entire central rectangular area, measuring about one hundred and fifty-five feet by thirty-five feet, is planted with evergreens and deciduous shrubs. This will give during the summer a solid effect of green, relieved by the masses of color produced by the flowers of the deciduous shrubs; while during the winter the dark green of the evergreens will make a pleasing contrast with the surroundings. Of the border of ten and one half feet referred to, a band eight feet wide has been devoted to herbaceous plants, made up largely of perennials, with some annuals, among which will be found many old-time friends.

The remaining two feet and a half has been retained in grass, making a green frame to the whole planting. Suitable show labels, giving desirable information, will be placed in position shortly.

In the planting of these plots, about one thousand conifers and broad-leaved evergeens have been used, five hundred deciduous shrubs, and two thousand two hundred herbaceous plants. It is a pleasure to again refer to the generosity of Mr. Lowell M. Palmer, who has contributed the large number of conifers and broad-leaved evergreens necessary to make this planting effective.

George V. Nash.

NOTES, NEWS AND COMMENT.

Under a Park Department contract with Kelly & Kelley, ground was broken on May 3 for the boiler house of the new public conservatories to be erected on the east side of the garden near the Bleecker Street entrance.

During the building of the masonry retaining walls at the driveway and path approaches to the Mosholu Parkway and the Woodlawn Road, it was of course necessary to break the border screen of trees and shrubs along the railway at those points. The gaps have been filled this Spring and the border screen is now intact from the Elevated Railway Station north to the Woodlawn Road. Considerable planting has also been done at the base of the retaining walls at both these driveway entrances.

Active work in the construction of the stone bridge to replace the old wooden "Blue Bridge" near the north end of the Hemlock Grove, has been in progress during the month of April under the Park Department contract with M. J. Leahy. The same underlying stratum of sand and gravel on which all the other bridges in the garden rest was found at this point and forms a footing for these structures which could not be better. This layer occupies a position about six feet below the average surface level of the river. As already described, this bridge is being built of boulders selected from old stone walls in the grounds and of others which grading operations have unearthed.

Much progress has been made in grading, sodding and sowing the banks about the lakes during the month of April and the telford foundation of the path system around the lakes is now very nearly complete, so that as soon as a supply of trap-rock screenings can be obtained they may be completed for the use of the public. It may be of interest to record that the price of broken trap-rock and trap-rock screenings has been greatly advanced since last year, competitive bidding last year bringing out a cost of $1.87 per cubic yard delivered at the garden, whereas the lowest bid obtainable this spring is $2.15 per cubic yard, and even at that figure it is difficult to obtain screenings free from a large amount of finely comminuted stone or sand.

Arbor Day exercises were held at the garden on May 2 and May 3 in connection with the nature-study lectures given to the children of the public schools of Manhattan and the Bronx. Remarks appropriate to the occasion were make by Dr. Britton and Dr. Murrill.

Dr. Hollick addressed the pupils of Curtis High School, New Brighton, Staten Island, giving an account of the origin and development of the movement and calling attention to the fact that the inauguration of Arbor Day in New York State was due to an act introduced in the State Assembly in 1888 by Assemblyman George Cromwell of Staten Island, now President of the Borough of Richmond.

The total precipitation recorded at the Garden for April was 4.93 inches. Maximum temperatures were recorded of 70° on the 5th, 56° on the 11th, 57° on the 21st, and 68° on the 25th;

also minimum temperatures of 26° on the 2d and 6th, 31° on the 11th, 29° on the 20th, and 37° on the 25th. The mean temperature was 48°, or 4.3° above the normal for April for New York State.

ACCESSIONS.

PLANTS AND SEEDS.

430 plants for the outside collections. (Purchased.)

26 plants for the outside collections. (Collected in the vicinity.)

64 plants from the Bahamas for the conservatories. (Collected by Dr. N. L. Britton.)

1 plant for the conservatories. (Given by Mr. Harding.)

1 plant for the fruticetum. (Given by Mrs. Dyer.)

1 plant for the nursery. (By exchange with the Bureau of Plant Industry.)

3 plants for the conservatories. (By exchange with Dr. I. D. Cardiff.)

24 plants for the conservatories from Cuba. (Collected by Mr. W. R. Maxon, by exchange with the United States National Museum.)

16 plants for the conservatories from the Bahamas. (Collected by Mr. L. J. K. Brace.)

1 plant for the conservatories. (Given by Mr. D. Griffiths.)

3 packets of seeds from Corea. (Given by Dr. R. T. Morris.)

89 packets of seeds from Siberia and Corea collected by Mr. T. N. Meyer. (By exchange with the Bureau of Plant Industry.)

19 packets of seeds. (By exchange with the United States National Museum through Dr. J. N. Rose.)

1 packet of seeds. (Given by Dr. H. H. Rusby.)

2 packets of seeds. (By exchange with the Royal Gardens, Kew, England.)

179 packets of seeds. (By exchange with the Botanical Garden at Leiden, Holland.)

18 packets of seeds. (By exchange with the Botanical Garden at Dublany Austria.)

18 packets of seeds. (By exchange with the Botanical Garden at Groningue, Holland.)

102 packets of seeds. (By exchange with the Botanical Garden at St. Petersburg, Russia.)

3 packets of seeds from Cuba. (Given by Prof. M. T. Cook.)

1 packet of seeds. (Given by Mr. R. C. Schneider.)

3 packets of seeds from Montserrat, W. I. (Collected by Dr. J. A. Shafer.)

130 packets of seeds. (Purchased.)

MUSEUMS AND HERBARIUM.

61 specimens from British America. (By exchange with the Geological and Natural History Survey of Canada.)

2 specimens of *Crataegus* from New Hampshire. (Given by Mr. Percy Wilson.)

100 specimens "Fungi Columbiana" Century XXIV. (Distributed by Mr. E. Bartholomew.)

2 specimens from Mexico. (Given by Mr. C. G. Pringle.)

1 specimen of *Nothoscordium* from Florida. (Given by Mr. S. Rapp.)

3,000 specimens from Montserrat and Antigua. (Collected by Dr. J. A. Shafer.)

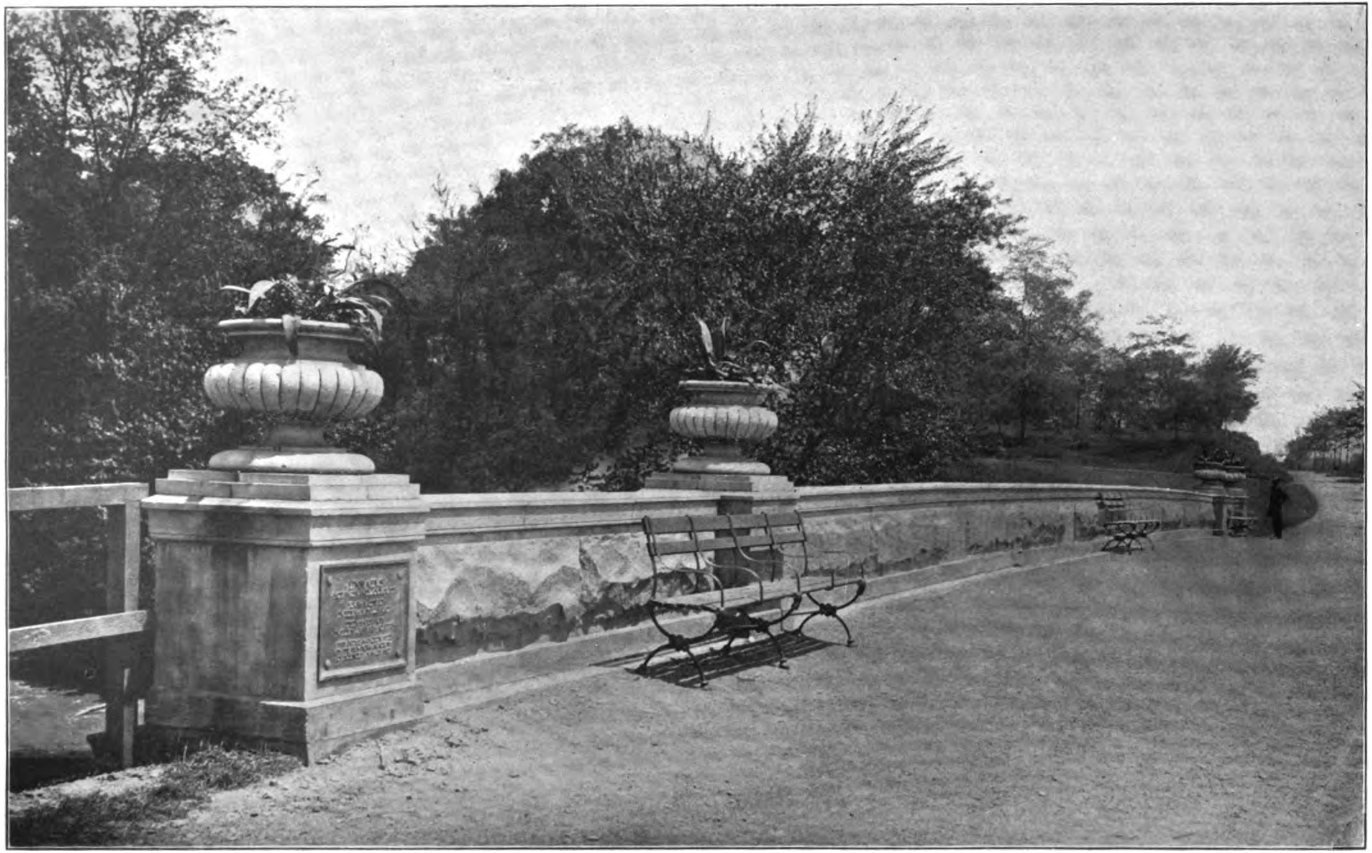
2 specimens of *Crataegus* from eastern Pennsylvania. (Given by Professor C. L. Gruber.)

200 specimens "Cryptogamae Formationum Coloradensium." (Distributed by Professor F. E. Clements.)

20 specimens of *Crataegus* from Missouri. (By exchange with Professor William Trelease.)

2,000 specimens from the Bahamas. (Collected by Dr. and Mrs. N. L. Britton.)

10 specimens from California. (By exchange with the University of California.)



THE LINNAEUS BRIDGE AND TABLET.

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EXERCISES COMMEMORATIVE OF THE TWO HUNDREDTH ANNIVERSARY OF THE BIRTH OF LINNAEUS.

Exercises commemorating the two hundredth anniversary of the birth of Linnaeus were held May 23, under the auspices of the New York Academy of Sciences, at the Museum of Natural History, the Botanical Garden, the Zoölogical Park, the Aquarium, and the Museum of the Brooklyn Institute.

In the forenoon, at the Museum of Natural History, American animals, shells, minerals and rocks known to Linnaeus were exhibited by a committee in charge, and letters and cablegrams from other societies appreciative of the work of Linnaeus were read by the Secretary of the Academy. Short addresses were also made by some of the representatives of these societies who were present. Then followed the main address of the morning by Mr. J. A. Allen on "Linnaeus and American Zoölogy."

Exhibition of American Plants Known to Linnaeus.

The exercises were continued in the afternoon at the Botanical Garden. Visitors were received under an arch bearing the name of Linnaeus decorated with flowers known to him and draped with the American and Swedish flags. After luncheon, an exhibition of American plants known to Linnaeus was held in the museum building. Nearly a thousand species of flowering plants, including potted plants and cut flowers, were shown, besides several species of ferns and a few of the lower cryptogams. The botanical writings and portraits of Linnaeus occupied a conspicuous place in this exhibition.

The following address was then delivered by Dr. P. A. Rydberg, Curator:

LINNAEUS AND AMERICAN BOTANY.*

Mr. Chairman, Ladies and Gentlemen:

I have been asked to make a short address to you on Linnaeus and his relation to North American botany. That the selection fell on me was not because I was the most able one to deliver such an address, for there are many abler men present, but simply because I was born in the same country as Linnaeus. In fact, my grandfather came from the same province of Smaland and

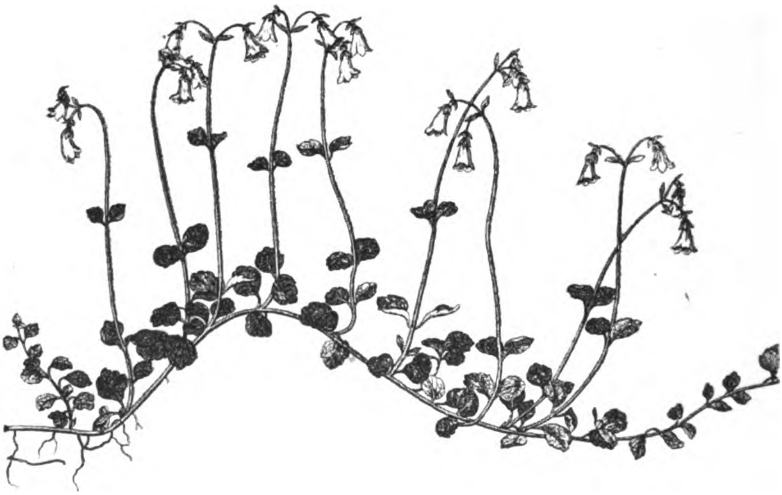

FIG. 16. The twin-flower, *Linnaea borealis*, a plant especially beloved by Linnaeus and dedicated to him by Gronovius.

even from a parish adjoining that of Stembrohult, in which my illustrious countryman was born.

In the early part of the seventeenth century there lived in Jonsboda, Smaland, Sweden, a farmer named Ingemar Svenson. He had three children, two sons and one daughter, the grand-

* Address delivered at the New York Botanical Garden, May 23, 1907, by Per Axel Rydberg, on the commemoration of the two hundredth anniversary of the birth of Linnaeus by the New York Academy of Sciences.

mother of Linnaeus. On the Jonsboda farm stood a very large linden tree, so old and with so many traditions that it was regarded by the people as a holy tree. Any damage done to this tree, it was claimed, would surely bring misfortune upon the head of the perpetrator. When the two sons began to study for the ministry, it was natural that they should think of this tree in selecting a family name. They called themselves Tiliander; *Tilia* is the Latin for the linden or basswood, and *andros* the Greek for man. It may not be amiss to state that at that time the common people of Sweden did not have any family names, and this is true to a certain extent even to-day. A man was known by his given name, the given name of his father with the word son appended, and the place where he lived. The farmer mentioned above was known as Ingemar Svenson from Jonsboda. His father's name was Sven Carlson and that of his grandfather, Carl Johnson. The names of his two sons would have been Carl and Sven Ingemarson had they remained in the peasant class, instead of Carl and Sven Tiliander.

The daughter married a farmer, Ingemar Bengtson, and her son's name was Nils Ingemarson, until he entered the "gymnasium." He was also born in Jonsboda and, when selecting a name, he naturally also turned to the same old linden tree as his maternal uncles had done. He called himself Linnaeus. It is remarkable that two of his father's maternal granduncles also bore another Latin form of the same name, viz., Lindelius. Some claim that even this name was derived from the same old linden tree, but this is scarcely in accordance with the facts. More likely it traces its origin from the Linden Farm in Dannäs Parish, where their ancestors lived.

But what has this genealogy to do with Linnaeus's relation to North American botany? Perhaps nothing directly, but indirectly a great deal; for the circumstances and surroundings under which a man is born and reared to a certain extent make the man. In his younger days, Sven Tiliander was the house-chaplain of Field-marshal and Admiral Viscount Henrik Horn, who was for many years Governor of Bremen and Verden, two cities with territory in Germany acquired by Sweden through the

Thirty-years War. During his stay in Germany, Tiliander learned to know and love botany and horticulture and established around Viscount Horn's residence in Bremen a garden which was remarkable for that period. When both returned to Sweden, Tiliander brought with him the choicest plants from this garden and planted them around the parsonage of Pjetteryd Parish, of which he had been appointed rector. Here at Pjetteryd, Nils Linnaeus spent most of his youth, studying in company with his uncle's sons. Later, both as curate at Rashult and as rector at Stenbrohult, he surrounded the parsonages with gardens, in which he grew many rare and interesting plants. In the midst of these, Carl Linnaeus, the famous botanist, was born and reared. Later, while a student at the university, he spent a summer vacation at home in 1732, and made a list of the plants in his father's garden. This list is still to be seen in the Academy of Sciences at Stockholm. Although defective, the first four classes being unrepresented, it enumerates 224 species. Of these, many were at that time very rare in cultivation. Professor Theodore Fries in his biography of Linnaeus enumerates 36 of the rarest of these. Among them we notice six American plants, viz., *Rhus Toxicodendron*, the poison oak, *Mirabilis Jalapa*, four-o-clock, *Asclepias syriaca*, milk-weed, *Phytolacca decandra*, poke-weed, *Antennaria* (now *Anaphalis*) *margaritacea*, pearly everlasting, and *Solanum tuberosum*, the potato. It may be remarked that the cultivation of potatoes was introduced into Sweden about twenty years later. We see from this that Linnaeus had learned to know some American plants even in his early childhood.

Carl Linnaeus was born the 13th of May (old style), 1707, at Rashult, an annex to the parish of Stenbrohult. His father was the curate there, but two years later, at the death of his father-in-law, Samuel Broderson, he became rector and moved to Stenbrohult. In the fall of 1714, Carl Linnaeus entered the school of Wexiö, and graduated from the "gymnasium" in 1727. His parents, especially his mother, wanted him to study for the ministry, but he had no love for theology, nor for metaphysics, nor the classics. He learned Latin tolerably, however, because that language helped him to study the natural sciences. He decided to study medicine and entered with that view the University of Lund, which was nearest his home, but remained there only one year, learning that there were better facilities at Upsala. At the latter place he soon became acquainted with Professors Rudbeck and Celsius, two of the most prominent scientists of that time,

FIG. 17. Linnaeus at the age of thirty, in Lapland dress.

and was allowed to use their libraries. The former, who had many duties to perform, soon asked Linnaeus to give for him the public lectures in Botany. The income from these gave Linnaeus means to support himself and linked him closer to his favorite study. He became acquainted with practically all the plants of the gardens and fields of the whole region around Upsala and learned all the scientific names given in the books at his disposal.

The latter was not an easy matter, when we take into consideration the form of scientific names at that period. For example, the most approved name of the common blue-grass that adorns our lawns was: "*Gramen pratense paniculatum majus, latiore folio, Poa Theophrasti.*" Other names of the same grass were: "*Gramen vulgo cognitum,*" "*Gramen pratense majus vulgatus,*" and "*Gramen alterum et vulgare.*" In the first publication by Linnaeus, it appears as "*Poa spiculis ovatis compressis muticis.*" I think that Linnaeus and his contemporaries had much more cause than we to exclaim: "Those horrible Latin names!" To us the same plant is known as *Poa pratensis* L., the name adopted by Linnaeus in his "Species Plantarum."

The lectures given by Linnaeus for Professor Rudbeck became very popular. This was especially the case after his return from his Lapland journey. Some persons, especially Dr. Nils Rosen, became jealous of his success and induced the University faculty to pass a resolution by which no one who had not taken the corresponding degree was permitted to give university lectures. Linnaeus had not yet received his doctor's degree, and hence was debarred. As Holland was offering at that time excellent facilities both in medicine and in botany, and as living expenses were lower than elsewhere, Linnaeus decided to visit that country and take his examinations there. He received his doctor's diploma at Harderwijk, and afterwards went to Leyden, where he became acquainted with three of the greatest botanists of the time, Boerhaave, Burmann and Gronovius. George Clifford, the wealthy burgomaster of Amsterdam and president of the East India Company, was a great lover of plants and had a splendid botanical garden at Hartecamp as well as a rich library and herbarium. On the recommendation of Boerhaave, Linnaeus became Clifford's physician and curator of his collections and garden. Here he lived in luxury, beloved as à son.

Clifford furnished Linnaeus with means to publish five of his first books, "Systema Naturae," "Fundamenta Botanica," "Bibliotheca Botanica," "Genera Plantarum" and "Flora Lapponica," the manuscript of which he had brought with him from Sweden. In the first of these, Linnaeus presents his system of classification. He divides Nature into three kingdoms, the mineral, vegetable and animal. In the vegetable kingdom, he brings out an altogether new classification, based upon the sexual organs of plants. He divides the kingdom into 24 classes, the first 23

FIG. 18. Linnaeus at the age of forty.

containing the phanerogams and the last the cryptogams. In the first 11 classes are included plants which have from 1 to 12 free and practically equal stamens; in the 12th and the 13th, plants with many stamens; in the 14th and 15th, plants with 4 and 6 stamens respectively, of which 2 are decidedly shorter; in the 16th, 17th and 18th classes the stamens are united by their filaments; in the 19th they are united by their anthers, and in the 20th they are adnate to the pistil; in the 21st and 22d the flowers are unisexual, *i. e.*, the stamens and pistils are in different flowers, on the same individual in the 21st and on different individuals in the 22d; and the plants of the 23d class have both unisexual and bisexual flowers. The classes were divided into orders. In the first 13 classes the orders were determined by the number of the pistils, in the 14th and 15th by the fruit; and in the 16th to 18th and 20th to 23d by the number and distinctness or union of the stamens. The classification of the 19th class is too complex to enter into here. The 24th class was divided into 4 orders: Filices, Musci, Algae and Fungi.

This system of classification is purely artificial. Linnaeus himself regarded it only as temporary, and expected that it would soon be supplanted by a more rational one, based on natural relationship. The Linnaean system served its purpose, however. It became a means by which it was possible to tabulate every known genus of plants. Before this time there had been no systems at all, or such crude ones as we find even to-day in some popular flower-books, where the plants are classified by the color of their flowers. If the natural systems of DeCandolle, Bentham and Hooker, and Engler and Prantl are too complicated for popular books, why not go back to the simple system of Linnaeus? It would at least give a good insight into the structure of the flower instead of the mere color.

In his "Genera Plantarum" Linnaeus applied this system to all known genera of plants and gave each of them a concise and plain description.

Clifford had many American plants in his garden, but he sent Linnaeus to England to visit Sir Hans Sloane, Professor Dillenius, and Philip Miller, in order to secure American plants grown by them. Both Sloane and Dillenius treated Linnaeus at first with coolness, because he "confounded" botany. On his farewell visit to Dillenius, Linnaeus politely asked him what he meant by "confounding botany." Dillenius took from the library the first few pages of Linnaeus's own "Genera Plantarum" and showed him where there was written at numerous places "NB." Dillenius stated that all the genera so marked were wrongly described. The first example he pointed out, if I am not mistaken, was *Canna*, placed by Linnaeus in his first class, which contains plants with but one stamen. Botanists before this time had described it as having three stamens. To settle the dispute they went out into the garden and the living plant showed that Linnaeus was correct. Dillenius then retained Linnaeus for several days and found that the older botanists in most cases were at fault and the young Swede correct. From being an opponent, he became a friend of Linnaeus and let him have all the plants he wanted.

After his return to Holland Linnaeus continued his work in Clifford's garden with renewed zeal; and completed his "Hortus Cliffortianus," a large folio, in which are enumerated and described all the plants found in Clifford's collections, together with synonyms and citations of nearly all botanical works then in existence. In preparing this work he became thoroughly acquainted with almost all the literature referring to American botany, such as Morison's "Plantarum Historia," Plukenett's "Almagestrum Botanicum" and "Phytographia," Petiver's "Gazophylacium," Sloane's "Jamaica," Plumier's "Plantarum Americanarum Genera," "Plantarum Americanarum Fasciculus Primus" and "Filicetum Americanum," Catesby's "Historia Naturalis," and, later, Cornuti's "Canadensium Plantarum Historia."

After completing the "Hortus Cliffortianus," Linnaeus returned to Leyden, where he spent some time helping Gronovius with the editing of his "Flora Virginica," based on a large collection of plants collected by Clayton. Here again he came in contact with American plants.

Linnaeus then returned to Sweden and became a practicing physician. He was soon appointed Professor of Medicine at Upsala, but by common agreement he exchanged chairs with Rosen, who held the professorship of Botany. He now began work upon the most important book of his life, his "Species Plantarum." In this he tried to include a short description of every known species of plant, together with the most important synonyms and citations. In this book the Linnaean binomial system of nomenclature was used for the first time. Linnaeus was not the first to give plants names; nor was he the first to name genera. Many Latin plant-names had come down from antiquity, while others had been proposed by his predecessors. Men like Tournefort and Micheli had in some cases clearer ideas of genera than Linnaeus himself. Neither was Linnaeus the first one to use binomials. In Cornuti's work on Canadian plants, for example, we find almost as many binomials as polynomials; but it is doubtful if Linnaeus had seen Cornuti's book when he first wrote his "Species Plantarum." He does not cite it in the first edition, but does so in the second. Linnaeus was, however, the first one to use binomials systematically and consistently. Before his time botanists had recognized genera and applied to them Latin nouns as names. In order to designate species, they added to these nouns adjective descriptive phrases. These consisted sometimes of a single adjective, as in *Quercus alba*, the white oak, but more often of a long string of adjectives and adjective modifiers, as in the case of the blue-grass mentioned above. The specific name had hitherto been merely a description modifying the generic name; from this time it became really a name, although a single adjective in form. An illustration of the pre-Linnaean form of plant-names might be had if, instead of "Grace Darling," one should say, "Mr. Darling's beautiful, slender, graceful, blue-eyed girl with long golden curls and rosy cheeks." "Grace" is just as descriptive of the girl as this whole string of adjectives. It may be that "Grace" is not always applicable to the person to whom the name is applied; but this is also often the case with many specific plant-names. *Asclepias syriaca* and *Rumex Brittanica* are American plants, and *Rubus deliciosus* is one of the least delicious of the raspberry tribe. This invention and strict application of binomial names could not but cause a revolution in Botany. Since the appearance of "Species Plantarum" in 1753 it has been possible to pigeon-hole not only genera, but also species of plants.

Before this useful book was printed, Linnaeus had become better acquainted with North American plants, and in another way. Baron Bjelke, the vice-president of the Court of Appeals of Finland, had proposed to the Royal Academy of Sciences at Stockholm to send an able man to Iceland and Siberia, countries partly in the same latitude as Sweden, "to make observations and such collections of seeds and plants as would improve the Swedish husbandry, gardening, manufactures, arts and sciences." Dr. Linnaeus suggested North America instead, and recommended one of his pupils, Professor Pehr Kalm, of Abo, for the proposed expedition. Kalm spent two years in North America, traveling through Pennsylvania, New Jersey, New York and Canada, and making large collections of seeds and plants, which were preserved as living or dried specimens or as alcoholic material. During his stay at Raccoon, New Jersey, he discovered our mountain laurel. The Swedes of Raccoon called it spoon-tree, because the Indians made spoons from its hard wood. Kalm adds in his journal about this tree: "The English call this tree a Laurel, because its leaves resemble those of the *Laurocerasus*. Linnaeus, conformably to the peculiar friendship and goodness which he has honored me with, has pleased to call this tree *Kalmia foliis ovalis, corymbis terminalibus*, or *Kalmia latifolia*." Here Linnaeus himself gave an illustration of both the pre-Linnaean and the post-Linnaean nomenclature. Kalm became acquainted with several of the naturalists of this country, C. Colden and his daughter Jane, Bartram and Clayton, and through Kalm a correspondence was established between them and Linnaeus. Linnaeus also corresponded with John Ellis, who resided in the West Indies, and Dr. Gardiner, who botanized in Carolina and Florida. Later he bought a set of plants collected by Patrick Browne in Jamaica, and received a part of the collections made by Jacquin in the West Indies.

When the second edition of the "Species Plantarum" appeared, in 1762, Linnaeus knew and had described nearly 1,000 plants indigenous to the United States and Canada. Besides these, he described about 1,000 more, natives of the West Indies, Mexico and Central America, and 400 or 500 South American plants. His knowledge of American plants was small compared with what he knew of plants of the Old World. "Codex Linnaeanus," which enumerates all plants named by Linnaeus, contains not fewer than 8,551 species.

Linnaeus died January 10, 1778, honored and esteemed by all. Some of his work will doubtless live as long as Botany is studied by man.

We see from the preceding account that we may consider Linnaeus one of our American botanists. Even the little plant

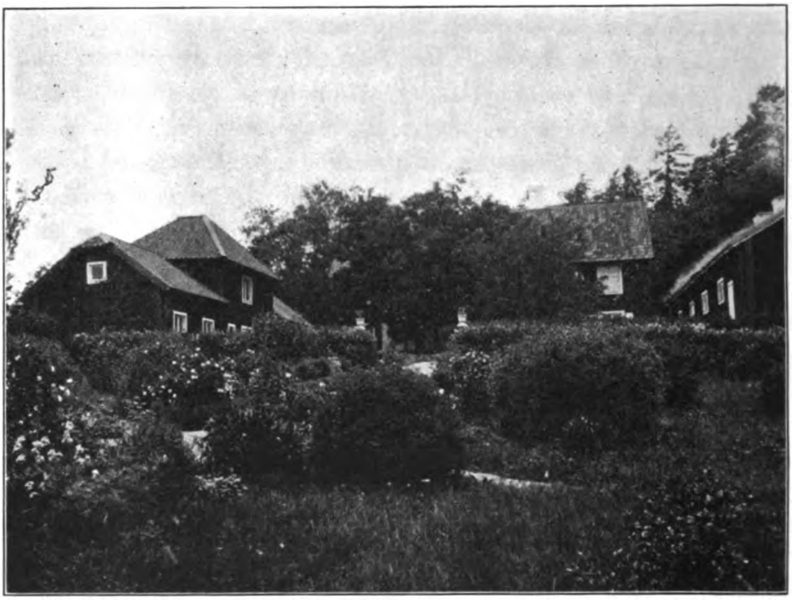

FIG. 19. **Hammarby, the country home of Linnaeus near Upsala, Sweden. From a recent photograph by W. A. Murrill.**

which Gronovius dedicated to the Father of Botany, the twin-flower of our woods, with its exquisite perfume and its dainty pink flowers, belongs to a genus essentially North American. The genus *Linnaea* contains four forms, all closely related. One of these, the original *Linnaea borealis*, is confined to the mountain regions of northern and central Europe. Linnaeus discovered it on his Lapland journey and it was then considered a very rare plant. Now it seems to be more widely distributed than it was at the time of Linnaeus. Perhaps it is of American origin and has become modified since it transplanted itself on the other side of the ocean. The other three forms are North American. *Linnaea americana* Forbes, which has usually been confounded with its European cousin, is common in the woods from Labrador to Alaska, and extends in the Rocky Mountains as far south as New Mexico. *L. longiflora* (Torr.) Howell, is found in the mountains from Northern California to Alaska. The fourth form is, as far as I know, undescribed and unnamed. It is with great pleasure that I here propose the following name and description for this species:

Linnaea serpyllifolia sp. nov.

A delicate plant with long creeping stems, 1–4 dm. long, sparingly hirsute; petioles 2–3 mm. long, ciliate; blades broadly oval or round-ovate, 5–8 mm. long, minutely crenulate, obtuse, sparingly hirsute, more or less coriaceous and shining, slightly paler beneath; peduncles 3–5 cm. long, sparingly pubescent and more or less glandular above, 2-flowered; bracts 2–3 mm. long, linear or lance-linear, obtuse; pedicels 5–8 mm. long, glandular-pubescent; hypanthium subglobose, in flower slightly over 1 mm. long, glandular-puberulent, purplish; calyx-lobes 2–2.5 mm. long, linear-subulate; corolla pink, open-funnelform with a very short tube, decidedly oblique, about 6 mm. long and 5 mm. wide.

This species differs from *L. borealis* and *L. americana* in the very narrow and almost glabrous calyx-lobes. In this respect, it agrees with *L. longiflora*: but it is distinguished from that species by the differently shaped corolla and by the leaves, which are broadest at or below the middle, instead of above it. It differs from all three in the smaller size of the flower and of the leaves, and in the indistinct toothing of the latter.

Alaska: Cape Nome, 1900, *F. E. Blaisdell* (Type in herb. N. Y. Bot. Gard.); Kotzebue Sound, *Arnott.*

Apparently the same plant has also been collected on the island of Sachalin by F. Schmidt, but his specimens lack flowers.

Exhibition of Lantern Slides of American Flowers Known to Linnaeus.

Dr. H. H. Rusby then showed selected colored lantern slides of the flowers of the following North American plants known to Linnaeus; early blue violet, hardhack, partridge pea, purple flowering raspberry, dwarf cornel, jack-in-the-pulpit, harebell, alumroot, meadow beauty, ground-nut, button-snakeroot, wake-robin, swamp rose-mallow, marsh-marigold, skunk cabbage, water hemlock, cardinal-flower, large blue flag, butterfly-weed, pickerel-weed, sea-side goldenrod, five-finger, large blue gerardia, black-eyed susan; sweet elder, swamp honeysuckle, witch-hazel, rhododendron; laurel magnolia, flowering dogwood, sweet-gum, locust-tree, black birch, fringe-tree, tulip-tree, and American linden.

American Trees Known to Linnaeus.

At the conclusion of the exhibition of lantern slides, Dr. W. A. Murrill led the way through the grounds of the Garden from the museum building to the Linnaeus Bridge and pointed out certain species of American trees known to Linnaeus. The following trees were observed, in the order given, and some of their characteristics briefly mentioned; tulip-tree, sweet-gum, red maple, red cedar, sweet birch, white pine, white ash, sugarberry, flowering dogwood, sassafras, buttonwood, butternut, white elm, red oak, white oak, hemlock, chestnut-oak, and American linden.

Dedication of the Linnaeus Bridge.

A handsome new bridge over the Bronx River on Pelham Parkway, between the Botanical Garden and the Zoölogical Park, was then dedicated by the unveiling of a bronze tablet commemorative of Linnaeus placed thereon by the Academy of Sciences. Dr. N. L. Britton, Director of the Garden and President of the Academy, made the following address:

Address by the President of the Academy.*

The recognition of the work of famous men is one of the happiest duties of mankind. It stimulates our endeavors and encourages us to make efforts which we would probably not make without their examples before us.

To-day we do homage to a distinguished man of science, and

* Delivered at the dedication to Linnaeus of the Pelham Parkway bridge over the Bronx River, by Nathaniel Lord Britton, President of the New York Academy of Sciences, May 23, 1907.

the unanimity with which the scientific societies and institutions of the City of New York join in this tribute is in itself evidence of the value which is placed upon his contributious to natural history.

Science has made great progress during the two centuries which have elapsed since the birth of Linnaeus. Theories have in large part given place to ascertained facts or have been replaced by other theories based on more accurate knowledge of natural objects and of natural phenomena. The contributions of science to the welfare, comfort and happiness of mankind have made present human life widely different from that of two hundred years ago, and this amelioration of our condition, and the more general diffusion of knowledge has been accompanied by a vast improvement in morality.

The ceremonies of to-day are worthy of the great naturalist whose birth they commemorate. Societies and institutions all over the world join with us in honoring him, and are represented here by delegates or have transmitted documents expressing their appreciation of his life and labors. The public natural science institutions of New York have come to take leading parts in the subjects they teach and illustrate. Public and private philanthropy have developed them with a rapidity almost phenomenal, for they are all yet in their infancy, and on a scale commensurate with the dignity of the metropolis of America. The cordial cooperation of a municipality with public-spirited citizens to build and maintain such institutions for the welfare of the people and of science, finds here, in New York, its maximum evolution, which has as yet, however, by no means reached its complete development nor its maximum usefulness. What shall be said of their position and importance when after fifty years the New York Historical Society opens the tablet which we now place upon this bridge? And, what discoveries will Science have made for the benefit of the human race during these next fifty years?

The selection of this bridge recently constructed by the Park Department, as a permanent memorial of Linnaeus, is most appropriate. It is situated just outside the New York Zoölogical Park, with the New York Botanical Garden a short distance to the north, being thus between the two institutions which teach the subjects on which the fame of Linnaeus chiefly rests. The suggestion that it be known hereafter as the Linnaeus Bridge came from the Director of the American Museum of Natural History.

On behalf of the New York Academy of Sciences I now unveil this tablet and present it to the City of New York, there having been placed in it copies of to-day's program and other documents befitting the occasion.

The tablet was then unveiled by Dr. N. L. Britton and accepted for the City by the Hon. Joseph I. Berry, Commissioner of Parks

FIG. 20. Tablet placed on the Linnaeus Bridge by the New York Academy of Sciences.

of the Borough of the Bronx. Its location is shown in the frontispiece, and its wording in the accompanying photograph.

The key of the tablet was accepted by the New York Historical Society for safe keeping until May 23, 1957. Addresses were made by Mr. G. F. Kunz, President of the American Scenic and Historic Preservation Society, and Mr. Emil F. Johnson

President of the United Swedish Societies of New York. Appropriate music was furnished by the American Union of Swedish Singers.

From the Linnaeus Bridge, the party entered the grounds of the Zoölogical Park and, under the guidance of Dr. W. T. Hornaday, the Director, and several members of his staff, examined the zoölogical collections with special reference to animals known to Linnaeus.

The exercises were continued in the evening at the Museum of the Brooklyn Institute with addresses by Messrs. F. A. Lucas and E. L. Morris, with an exhibition of lantern slides, and musical numbers by the Glee Club of the United Swedish Societies.

A reception at the Aquarium given by the New York Zoölogical Society to the New York Academy of Sciences and Guests, about five hundred people in all, closed the exercises of the day. Features of marine life known to Linnaeus were then demonstrated, and the first view was had of the Aquarium collections under illumination by night. The centennial of the Aquarium building was commemorated at the same time.

W. A. Murrill.

NOTES, NEWS AND COMMENT.

Miss Anna Murray Vail, Librarian, is at present in France, where she intends to remain during the summer.

The seventh annual meeting and exhibition of the Horticultural Society of New York was held at the Garden on Wednesday and Thursday, May 8 and 9. The seventh summer exhibition was held June 12 and 13.

Dr. Per Axel Rydberg, Curator, delivered an address at Augustana College, Rock Island, Illinois, on May 13, in connection with exercises commemorative of the two hundreth anniversary of the birth of Linnaeus.

The exercises at the Garden in honor of Linnaeus were attended by the Swedish Minister, from Washington, and by the Swedish Consul, Vice-Consul, and President of the United Swedish Societies, from New York.

Mr. Wladimir H. Lipsky, the well-known Russian botanist and botanical explorer, recently spent several days at the Garden examining the library and collections.

The nature-study lectures and demonstrations for the benefit of pupils of the public schools in the borough of the Bronx and a portion of Manhattan closed for the spring term on June 4, to be continued in the autumn.

A collection of fossil gums containing some very rare and choice specimens has just been presented to the Garden by Messrs. G. W. S. Patterson & Co. of this city. A description of this collection will be published at an early date.

The total precipitation recorded for May, 1907, was 4.05 inches. Maximum temperatures were recorded of 72° on the 10th, 83° on the 14th, 70° on the 24th, and 71° on the 30th; also minimum temperatures of 34° on the 5th, 30° on the 12th, 44° on the 18th, 37° on the 22d, and 41° on the 28th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM APRIL 15 TO JUNE 1.

ARKANSAS. *Annual report of the geological survey for 1888.* Vol. 3. Little Rock, 1888. (By exchange with the Library of Congress.)

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BELLI, S. *Observationes critiques sur la réalité des espèces en nature au point de vue de la systématique des végétaux.* Turin, 1901. (Given by Dr. N. L. Britton.)

BENINCASA, MICHELE. *Come si coltiva il tabacco.* Parte prima and parte secunda. Roma, 1907.

Botanical magazine; index from its commencement in 1787 to the end of 1904. London, 1906. (Deposited by the Trustees of Columbia University.)

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DUTROCHET, HENRI. *Physiologische Untersuchungen über die Beweglichkeit der Pflanzen und der Tiere.* Leipzig, 1906. (Deposited by the Trustees of Columbia University.)

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GODFRIN, J., & NÖEL, CH. *Atlas manuel de l'histologie des drogues simples.* Paris, 1887.

GREENWOOD, LAURA. *Life among the flowers.* New York, 1880. (By exchange with the Library of Congress.)

HANAUSEK, T. F. *Die Nahrungs- und Genussmittel aus dem Pflanzenreiche.* Kassel, 1884.

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LANGE, JOH. *Revisio specierum generis Crataegi imprimis earum, quae in hortis Daniae coluntur.* Kjobenhavn, 1897.

MANN, GUSTAV. *Chemistry of the proteids.* London, 1906.

MICHAEL, HELEN ABBOTT. *Studies in plant and organic chemistry and literary papers.* Cambridge, 1907. (Given by Mr. Francis R. Abbott.)

MICHAUX, ANDRÉ. *Travels west of the Alleghanies made in 1793–96 by André Michaux;* in 1802 by F. A. Michaux; and in 1803 by Thaddeus Mason Harris. Edited by Reuben Gold Thwaites. Cleveland, 1904.

MIGULA, W. *Exkursionsflora von Deutschland zum bestimmen der häufigeren in Deutschland wildwachsenden Pflanzen.* Leipzig, 1906. 2 vols. (Deposited by the Trustees of Columbia University.)

NEWSTEAD, ROBERT. *Monograph of the Coccidae of the British Isles.* London, 1901.

NISBET, JOHN. *Our forests and woodlands.* London, 1900.

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SWEET, ROBERT. *Geraniaceae, the natural order of Gerania.* London, 1820–30. 5 vols.

TUCKER, ARABELLA H. *Trees of Worcester.* Worcester, 1894.

WARDER, JOHN A. *Report on forests and forestry.* Washington, 1875.

WILLAN, RHODA MARIA. *Flora Parvula;* or, gleanings among favourite flowers. London, no date. (By exchange with the Library of Congress.)

WILLIAMS, H. L., & LANGDON, E. C. *From one generation to another.* New York, 1906. (Given by Mrs. N. L. Britton.)

ZEILLER, R. *Etudes sur la flore fossile du Bassin Houiller et permien de Blanzy et du Creusot.* Paris, 1906. 2 vols. (Given by Dr. Arthur Hollick.)

MUSEUMS AND HERBARIUM.

4 mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

287 specimens of *Rubus* from eastern North America. (Collected by Mr. W. H. Blanchard.)

300 specimens of marine algae from the Barbados. (Collected by Miss Annie L. Henderson.)

1 specimen of *Polyporus anceps* from Massachusetts. (Given by Professor E. A. Burt.)

30 specimens for the economic museum from Montserrat, W. I. (Collected by Dr. J. A. Shafer.)

1 bowl made of a redwood burl from California. (Given by Mr. Rodney Burns.)

6 specimens of cassava starch and products from Montserrat, W. I. (Given by Mr. A. S. Weeks.)

539 specimens from Central America. (Collected by Mr. H. Pittier.)

1 specimen of *Claytonia multicaulis* from Iowa. (By exchange with Mr. M. P. Somes.)

1 specimen of *Puccinia melothriae* from North Carolina. (Given by Dr. F. L. Stevens.)

1 specimen of *Pterospora Andromedea* from California. (Given by Mrs. H. L. Britton.)

490 specimens from Mexico. (Collected by Dr. C. A. Purpus.)

PLANTS AND SEEDS.

55 plants for woody collections. (Purchased.)

1 plant for herbaceous garden. (Given by Mr. E. S. Steele.)

19 plants for conservatories. (Purchased.)

1 plant for herbaceous garden. (Given by Dr. L. R. Abrams.)

6 plants for herbaceous garden. (Given by Miss D. W. Marble.)

1 plant for herbaceous garden. (Collected by Dr. J. A. Shafer.)

520 conifers for nurseries. (Given by Messrs. I. Hicks and Son.)

1 plant for herbaceous garden. (Given by Mr. E. N. Howell.)

51 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

2 plants for herbaceous garden. (Given by Dr. D. T. MacDougal.)

1 plant for herbaceous garden. (Given by Dr. H. J. Banker.)

9 plants for conservatories. (Given by Messrs. Siebrecht and Sons.)

1 plant for herbaceous garden. (Collected by Dr. P. A. Rydberg.)

1 plant for conservatories. (By exchange with Mr. Oakes Ames.)

1,800 plants derived from seeds from various scources.

1,127 plants for woody collections. (Given by Mr. Lowell M. Palmer.)

24 plants for conservatories. (Given by Mr. Lowell M. Palmer.)

1 packet of seeds from the Bahamas. (Collected by Dr. N. L. Britton.)

1 packet of seeds from Colorado. (Given by Mr. D. M. Andrews.)

3 packets of seeds from California. (Given by Mr. S. B. Parish.)

1 packet of seeds from Mexico. (Given by Mr. J. T. Nagle.)

8 packets of seeds from California. (Given by Mrs. H. L. Britton.)

1 packet of seeds from Antigua. (Collected by Dr. J. A. Shafer.)

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THE BREATHING OF PLANTS.*

There is probably no scientific question concerning which erroneous notions are more wide spread than the one regarding the difference between animals and plants. Ask the "average man" what this difference is and he will tell you, in the first place, that animals have motion while plants have not; or, if he is especially conservative, that animals have locomotion while plants have not; and, second, that plant respiration is just the reverse of animal respiration. Animals, he says, "breathe-in oxygen and breathe-out carbon dioxide, while plants breathe-in carbon dioxide and breathe-out oxygen." It is with the latter of these "differences" that we are concerned in the following paragraphs.

By way of a gentle introduction it may be stated at once that plants breathe precisely as do animals, and, second, that they do not "breathe" at all. This seeming contradiction is explained when we remember that, as we think more accurately, our terms must be more carefully defined. In ordinary conversation "breathing" refers to the inspiration of fresh air into the lungs, and the expiration of the air that has been used. Obviously plants have no lungs. We cannot *see* them breathe.

But this exchange of fresh and foul air is only incidental to the real physiological process, properly termed respiration. Not all animals have lungs. Earthworms, insects, jelly-fish, and others may be mentioned as familiar examples of this fact. The

* From a lecture delivered at the New York Botanical Garden, October 27, 1906.

real process, to which the physiologist applies the term respiration, has to do with the use that is made of the inspired air. From the lungs this air, in man for example, is taken up by the blood. Part of it the blood uses in its own respiration, the remainder it carries to all the tissues of the body, and delivers it to the individual protoplasmic units or cells. These cells take up the oxygen according to their needs, use it in performing their work, and return to the blood the carbon dioxide that results. Carried by the blood back to the lungs, the carbon dioxide is given off to the air in expiration. All of this is common knowledge. Respiration refers to that part of this process which goes on in the individual cells, while the term breathing may be to advantage restricted to the work of the lungs. Respiration, then, is a cell-process, and every organism that is alive, and every living cell of that organism must respire. The cells of our fingers, our eyes, and our hearts respire, as well as do those of the lungs. All plants are built up of cells, some of which are alive and some not. All the living cells of plants respire, just as truly as do those of animals.

It is difficult to demonstrate the cell processes, but the outward manifestation of them — the absorption of oxygen and the evolution of carbon dioxide — is very easily shown.

Into each of six fruit jars place portions of the different parts of plants as follows: into the first fresh roots, into the second stems, into the third leaves, into the fourth flowers, into the fifth germinating seeds, and into the sixth nothing. A lighted candle will continue to burn when placed in any of the jars. Seal them all air tight. If, at the end of twelve hours, a lighted candle is thrust into each of the jars, it will be extinguished in each of the first five, but will continue to burn as usual in the sixth. This shows us that the air in the five jars has become poorer in oxygen, while that in the sixth jar is apparently unchanged. If now we pour clear lime-water into each of these jars, the water will become milky in each of the first five, but will remain clear in the sixth. This indicates that in the first five the amount of carbon dioxide has been increased, but not so in the sixth.

Since the only difference between the first five jars and the sixth is the presence, in the former, of parts of living plants; we must conclude that the change in the air is due to the vital activities of the roots, stems, leaves, flowers, and seeds. But an absorption of oxygen and an evolution of carbon dioxide, we have learned, is the outward indication of the cell-process called respiration. In this, and in many other ways, it may be shown that plants respire.

It will be seen here that plant respiration is not confined to the leaves. Nothing can be more misleading than to speak of leaves as the "lungs of plants." If any comparison at all is to be made they could better be called the stomachs of plants, for in them processes of digestion go on with as much, if not more, vigor than does respiration. Moreover many kinds of plants such as bacteria, algae, fungi, liverworts, and others, have no leaves, but respiration goes on in them notwithstanding, and trees in winter, after all the leaves have been dropped, continue still to respire.

No vital activity is as important as respiration. Food may be supplied, water and air may be abundant, but without respiration life is impossible. The power to respire marks the chief difference between the living and the non-living. In the realm of living things it is universal and incessant. It is always in all essentials, the same process, whether in plants or in animals. The failure to recognize this fact gave rise in the latter half of the last century to the doctrine of vital dualism. Because of the supposed difference between animal and plant respiration, it was argued that there were two kinds of life. A clearer understanding of the vital processes of animals and plants, however, has taught us that life is one. No clearly defined line can be drawn between the two kingdoms.

As great differences exist between certain animals, and between certain plants, as are found between animals and plants. But the process of respiration is everywhere the same. Even dry seeds, which certain German physiologists have considered as in a condition of "*Scheintodt*" (apparent death), are respiring. The boquets in our vases, the celery and lettuce on our tables, the potatoes and apples in our cellars, as well as the trees, shrubs and herbs, indoors and out, are constantly, day and night, taking in oxygen, exchanging it in the living cells for carbon dioxide, and returning the latter to the surrounding air.

Even in regard to the amount and rate of respiration the supposed difference between animals and plants breaks down. Under favorable conditions the process may be even more active in plants than in animals. In man the carbon dioxide produced in twenty-four hours equals about 1.2 per cent. of the body weight, but in some of the moulds the amount has been found to equal 6 per cent. of the dry weight of the plant. Bulk for bulk, very active bacteria may consume oxygen 200 times more rapidly than man. In both kingdoms respiration is accompanied by an evolution of heat.

In plants, as in animals, the rate of respiration varies with the age of the organism, and with external conditions. Breathing, which is the expression of respiration in man, is most rapid with infants, and decreases with the approach of old age. So it is with plants, for germinating seeds and young seedlings respire more rapidly than mature plants. Increase of work is accompanied with increase of respiration in animals: in trees, also, the process is more vigorous in the spring, during the work of bud-opening and the putting forth of new leaves and flowers. Under bodily pain or mental excitement we breathe more rapidly, so also does a plant that has been cut, or otherwise injured, or subjected to any stimulus, as, for example, violent shaking. A thermometer placed in a dish of cut onions, for example, will indicate the existence of a fever (due to the wounding of the tissue), just as surely as if placed in the mouth of a typhoid patient.

This question is far from having a merely academic interest, Practices that have been in vogue since man first began to till the soil, and that must be continued as long as agriculture is carried on, depend, in part, upon the respiratory function of plants. I refer to plowing the soil and hoeing the crops. It is not alone to get the soil into a suitable physical condition that it is broken up by the farmer. The roots and other underground parts must have air to respire, just as much as the parts above ground, but if the soil is hard and compact this need is but poorly met. The plow, the spade, and the hoe facilitate the thorough aëration of the ground. For the same reason it is desirable frequently to loosen the surface of the soil in flower pots, and this, in part, is why flower pots are made of porous material.

Emphasis has been laid upon the fact that only living things respire. While this is perfectly true of the physiological process, it is not true of the mechanical act which may be designated as breathing. The entire soil area of the globe is subject to great inspirations of atmospheric air, and expirations of the gases resulting from life processes underground. This process is necessary to the healthful respiration of soil-organisms, and of the underground portions of all land plants. Without it land vegetation would perish and the world would become a desert.

The "breathing" or aëration of the soil is accomplished in a variety of ways. In all regions where it has a depth of fifty feet or more, the ground at a certain distance below the surface is soaked with water, so that all the spaces between the soil particles are completely filled. The upper surface of this moisture is called the water-table, and above it the soil contains only capillary water. The interspaces between the soil particles are filled with air, and only the surfaces of the grains are wet. The level of water in a well marks the level of the water-table in the soil. In the spring, and in other wet seasons, this water-level stands at a greater height than in periods of dry weather, and, as it falls, air from above ground enters the soil. When the water-table rises, gases are forced out.

The gradual heating of the soil during the day causes the soil-air to flow out, while the nocturnal cooling is accompanied by a current in the opposite direction. Wind blowing over the surface causes an outflow, the calm that follows an inflow. Thus the great soil-breathing goes constantly on.

It is in this way that fresh air is continually supplied, not only to roots, but also to the soil-bacteria, some of which are able to convert the nitrogen of the air into a form available to other plants, others of which are able to convert the ammonium-compounds into nitrates and the nitrates into nitrites, in which form it may be utilized by higher plants. For we must remember that bacteria must respire as truly as ourselves.

The question as to what becomes of all the roots, and why the soil never becomes clogged, may possibly never have occurred to some of us. Several causes explain this, one of which is the process of putrefaction, which is explained by the respiration of a certain kind of microscopic plants. These plants are called *anaërobes*, because they normally respire anaërobically, that is, without the presence of free external oxygen. Some of them are unable to respire at all if free oxygen surrounds them. If, therefore, the aëration of the soil is interfered with, these plants find ideal conditions for their growth and activity, and the soil becomes "sour," and unfit for crops.

From the above considerations it becomes clear that agriculture, the most fundamental of all human industries, depends for its successful pursuit upon practices whose whyfore is found in the fact that plants respire.

But husbandry is not the only point where the respiration of plants touches our daily lives. Upon the respiration of the yeast-plant depends the enormous brewing industry of our own and other countries, and upon the respiration of another yeast-plant we are dependent for the lightness of our daily bread, for the fermentation involved in "raising" dough is a kind of respiration. The difference between a "good" and a "bad" cigar is partly attributable to a similar cause, for the difference is connected with the curing of the tobacco, and this process involves the respiration of bacteria. So, too, does the tanning of hides, and the separation of flax and hemp fibers from the plants that produce them.

Cold storage warehouses and refrigerator cars are made necessary, in part, because of the respiration and universal presence of myriads of microscopic plants that float in the air, for, whereas heat accelerates respiration, cold retards it. The turning rancid of butter, the souring of milk, the formation of vinegar from cider, are all dependent upon the same process. If plants did not respire canned fruits and meat would seldom spoil. That a hen's egg is a miniature botanical garden is a bit of that truth that is stranger than fiction. The ovophytic flora enters the egg in the body of the fowl, before the formation of the shell, and the respiration of the entombed plants is one reason why eggs will not always remain "strictly fresh," and why cold storage will prolong the period of their freshness.

The difference between green and black tea is largely owing to the fact that, in the case of the latter, microscopic plants have been allowed to respire among the moist leaves of the tea plant until a critical point is reached, when the plants are killed and the respiration stopped. A well regulated banquet must terminate with cheese and black coffee; but is the cheese Camembert, Roquefort, Neufchatel, Brie, or Schweitzer? That depends upon the kind of plants that respired within the cheese during the process of its ripening. Formerly it was not thought possible to produce a given kind of cheese except in a given native locality; but this is no longer so, for, since it has been known that the difference depends upon the activity of plants, these little organisms can be shipped to any locality where it is desired to manufacture a given kind of cheese.

The wide range of relationships indicated above depends upon the fact that carbon-dioxide and water are not the only by-products of respiration. Many other substances result, the discussion of which would lead us into technicalities beyond the scope of the present lecture.

But someone may be raising the question of the value of plants in the sick room. It is hardly necessary to more than mention the subject, for now that we know that plants are continually respiring, and in precisely the the same manner as are animals, it is at once recognized that they would have the same kind of an effect on the air of a room that a person or a burning gas jet would have, though possibly not to the same degree. If the plants were abundantly supplied with green leaves, and were well exposed, even to bright diffused sunlight, they would supply an insignificant amount of oxygen to the air. But at the same time they would be sources of carbon dioxide. And when we recall that the "plants" in a sick room are usually cut flowers, often not over fresh, and that flowers respire more vigorously than any other part of a plant except germinating seeds, we do not need to be further enlightened as to their power of purifying the air. Our scientific knowledge, however, should not, as it is often liable to do, get the better of our "sense uncommon, men call common sense," for the brightness and cheer that flowers bring to the sick need never be sacrificed for fear of their evil effects upon the air.

The discovery and elucidation of plant respiration was one of the most, if not the most, important contributions ever made to the science of plant physiology. It throws a flood of light upon metabolism, and in metabolism is locked up the secret of secrets, whose finding out is the ultimate problem of all biology, viz., the answer to the question, What is life? It is fitting, therefore, that we should know something of those masters of experimental investigation, to whose wonderful skill and untiring labors we are indebted for what is now known of the subject.

Since the process involves an understanding of the relation between plants and air, it is obvious that it could never be understood until the nature and properties of air were clearly comprehended. On this question we are all familiar with the fantastic notions of antiquity. Thales, of Miletus, had taught that all things were made from water, but Anaximenes, his fellow townsman, declared that everything is made of air. And, since it is the air that gives his life to man, it must be his very soul. From this it was justly inferred that the infinite air was God, and that it is the source of all the gods and goddesses.

Diogenes, of Apollonia, went a step farther, and said that the whole world is a living being. Air is not only the soul of man, but also the soul of the world. By an ingenious logic, he reasoned that air "knows much." "But that which has knowledge," said he, "is that which men call air; it is it that regulates and governs all, and hence it is the use of air to pervade all, and to dispose all, and to be in all, for there is nothing that has not part in it." * How surprised he would be to-day to find how near he came to expressing the truth! Since, said Diogenes, plants have no air cavities, and since they are wholly unintelligent, the intelligence of man is due to the flowing of air through his body in the blood.

* Draper, Intellect. Devel. Europe, p. 73. New York, 1870.

These early notions persisted for centuries and were slow to disappear, for when the early investigators discovered the component fluids of the air they called them ghosts. The term has persisted to this day, only we translate the German *Gahst* or *Geist*, by *gas*, and speak of the various *gases* of the air.

We are indebted to Van Helmont for the first experimental knowledge of the nature of air, and of the relation to it of plants He is one of the most peculiar figures which the history of science presents to us. Born (in 1577) in an epoch of transition, he formed, says Claude Bernard, the connecting link between the mystic savants of the middle ages and the modern experimentalists.

As many of his biographers recall, Van Helmont possessed concerning fire, air, gas, earth, and water knowledge well in advance of those of his time. He had a clear perception of aëriform fluids, and of their rôle in chemical phenomena. He first gave attention to organic chemistry, was the first to introduce the balance and computation into his researches, determined the nature of flame, and laid the foundation for the chemistry of air. It was he, moreover, who coined the word *gaz* or *gas*, and used it as it is understood to-day.

Chemistry and plant physiology are indebted to Van Helmont for an experiment that is very remarkable, considering the age in which it was made. This experiment consisted in effecting the combustion of 69 pounds of oak carbon. After the carbon had been consumed there remained only one pound of ashes. Van Helmont concluded that 68 pounds of carbon had been converted into an invisible air, which he called the *gas*, or spirit of the wood. It was he who discovered the property of this gas of turning lime-water milky. Subsequently he found it in fermentation vats, and in air that will not support respiration or combustion. It was the gas which to day we call carbon dioxide, the discovery of which is thus due to him. Van Helmont died in 1644. He was the last of the alchemists.

Notwithstanding the example of Van Helmont, the world was slow in adopting the experimental method. Scientists continued to discuss what they *thought* was so, or what ought to be so.

For this and other reasons we find scientific literature for the next hundred years, and even as late as the middle of the nineteenth century, burdened with a mass of misinformation, such as, for example, the notion that leaves are the lungs of plants, that they inhale by one surface and exhale by the other, that in breathing the inspiration was at night and the expiration at day.

One preconception that was a hindrance to progress was the idea that plants possessed a system of organs and functions analogous to those of animals. This thought is most fully elaborated in that strange poetical-scientific book, *The Botanic Garden*, published in 1791 by Erasmus Darwin, grandfather of the great evolutionist. "It is easy to conceive," says the author, how a peristaltic contraction produces the flow of sap in plants. "There is . . . a complete circulation in the leaf; a pulmonary vein receiving the blood from the extremities of each artery, on the upper side of the leaf, and joining again in the foot-stalk of the leaf, these veins produce so many arteries or aortas, which disperse the new blood over the new bark. . . . And I was induced to believe the existence of a venous system corresponding to the arterial one in the barks or roots of plants, as well as in their leaves and petals. . . . I think there can be no doubt that the leaves of trees are their lungs. . . . The circulation in the lungs or leaves of plants is very similar to that of fish."

So late as 1830 Brongniart described a circulation in plants analogous to that of the blood in animals.

It is easy enough for us to smile at these crude ideas, but I wonder what the scientific world will be saying of us one hundred years from now, or how broadly the audience will smile then as some lecturer quotes from the books we take so seriously, to emphasize how superior is the knowledge of his time over the hazy notions of 1906. The difference between the Darwin who died in 1802 and the one who was born in 1809, is not so much a difference of mental ability, as of mental inheritance. The pioneers of science have labored, we have reaped the benefits.

I must pass over the work of Black, who discovered that carbon dioxide is a constituent of the atmosphere, of Ray and Boyle, who discovered that seeds would not germinate in a vacuum, of

Saluce who "demonstrated" that air in which candles had burned out was vitiated by the heat, and could be restored by exposure to extreme cold, and of Hales, who, as late as 1769, taught that respired air was vitiated because it had lost its elasticity.

The scientific successor of Van Helmont was Joseph Priestley, preacher, historian, linguist, theologian, revolutionist, scientist. Born in 1773, he became pastor of the church at Needham at the age of twenty-five, but was forced to leave the place because of his Unitarian tendencies. He was versed, not only in Latin and Greek, but also in Hebrew, Arabic, Chaldee and Syriac. Among his writings one finds such titles as Theory of Languages, Oratory and Criticism, The Constitution and Laws of England, Matter and Spirit, Comparison of Heathen and Christian Philosophy, The Doctrine of Necessity, The French Revolution, On the American War. Laughed at in France for being a Christian, he was decried in his own country for being what many called an atheist. After being attacked by a mob which tore down his house in Birmingham, because of his sympathy with the French Revolution, he went to London, but could hardly secure lodgings there, as every one feared that the house in which he dwelt would be torn down. Shunned by members of the Royal Society, he took refuge in America, and made discoveries enough in science to make half a dozen men famous.

"The interrogation point," said DeCandolle, "is the key to all the sciences." With this key Priestley unlocked the door that led to the discovery which became the foundation of both chemistry and physiology, the discovery of oxygen gas. This discovery was celebrated at the grave of Priestley, in Northumberland, Pa., on August 1, 1875, as the starting point of modern chemistry. It was Priestley, also, who discovered the osmosis of gases through a bladder membrane. He rejected Van Helmont's term "gas," as being a needless introduction of a new term, and in its stead employed the word air in a generic sense.

The discovery of oxygen, in the year 1775, is described in his "Treatise on different kinds of air." Chemists in that day knew that the atmosphere contained "fixed air" (carbon dioxide), "phlogisticated air" (nitrogen), and "phlogiston," a term used then as many of our terms are used now, to cover up ignorance. Priestley furthermore recognized that all of these components were unfit to support respiration and combustion. They extinguished flame and life alike. What is it then, that makes burning and respiration possible?

He sought the answer to this question in nature herself. The method was that of experiment. In order to ascertain the effect of these different "airs," he placed in them small animals. He clearly showed that combustion, respiration, fermentation, and putrefaction all have a similar effect on the surrounding air. He became especially interested in trying to find out why the air never becomes permanently vitiated by respiration, and why animals do not suffocate, though a multitude of generations of living beings have worked for millions of years to vitiate the air by absorbing immense quantities of "dephlogisticated" air (oxygen), and returning oceans of "fixed air" (CO_2), and though the fixed air is continually supplied from flames, volcanoes, and other sources. The theory of Saluce, referred to above, was based upon the fact that cold prevents fermentation and putrefaction, while heat promotes them. Priestley resolved to test that theory by means of experiment. To that end he burned candles in an enclosed space, or let animals remain there until the air would no longer support combustion or respiration. This air was then exposed to the cold of a hard frost, but even then flames went out, and animals expired when placed in it. Thus the theory of Saluce was disproved, as well as another current theory that heat vitiated the air, for animals lived at ease in air that had been passed through hot tubes. What could the true explanation be? Again the question was put direct to nature. "It becomes," said Priestley, "a great object of philosophical inquiry, to ascertain what change is made in the constitution of the air by flames, and to discover what provision there is in nature for remedying the injury which the atmosphere receives by this means."

Priestley found that animals could not live in air in which a candle had burned out; he also demonstrated the converse, showing that a flame would not burn in air vitiated by the respiration of a mouse. We can hardly overestimate the importance of this experiment. It was the first experimental evidence of the similarity between combustion and respiration (confirmed later by Lavoisier), and marks the first step into the realm of physiological chemistry.

See now the unlocking power of the interrogation point. Do plants, said Priestley, behave as animals do? Can they live in an atmosphere where animals suffocate and flames go out? Then followed that famous experiment in which, after a mouse had suffocated under a bell-jar, and it was shown that another mouse expired instantly when introduced into the same jar, that a sprig of mint was placed in the same space. Not only did it not die, but it thrived with unusual vigor. Moreover the air after ten days, would enable a mouse to breathe with the greatest of ease. When later experiments of Priestley gave sometimes different results, and seemed to indicate that plants may also vitiate the air, he rejected these as "bad experiments," and accepted only the "good experiments."

See, in his own words, by how narrow a margin he missed the discovery of plant respiration. "I have found that a fresh cabbage leaf, put under a glass vessel filled with common air for the space of one night only, has so affected the air, that a candle would not burn in it the next morning, and yet the leaf had not acquired the smell of putrefaction." However he attributed the result to incipient putrefaction. It is a source of regret to us all to know that the discoverer of oxygen died in ignorance of the fact that it is concerned in plant respiration, or even that it had anything to do with combustion, for his last published writing was a lengthy and spirited defence of phlogiston, and a refutation of the theory that combustion is merely rapid oxidation.

Priestley is universally acknowledged as the discoverer of oxygen, but his claim rests partly upon priority of publication. Two years before the appearance of his treatise, the same discovery had been made in Germany by Karl Wilhelm Scheele, but no public announcement was made of it. Priestley had called oxygen dephlogisticated air; Scheele called it "fire air." He proceeded at once to find out all he could about it, and found, among other things, that germinating pea seeds convert it into what he called "aërial acid," his name for carbon dioxide. Thus, in a chemical laboratory, by a chemist, was made the discovery of plant respiration. These experiments were afterwards confirmed by Lavoisier, the father of modern chemistry.

In 1770, Jan Ingen-Housz, trying to straighten out the contradiction of Priestley's experiments, placed green plants in sunlight under water and showed that sunlight and leaf-green were both necessary for the evolution of oxygen, but he thought that the oxygen came from the water. Twelve years later Senebier proved that the oxygen came from the plant, and resulted from the carbon dioxide which the leaves had first taken from the water.

Finally, in 1821 and 1822, Théodore de Saussure established the fact that oxygen is indispensable to the life of the plant, and that all parts of the plant, in darkness as well as in light, take in oxygen and give off carbon dioxide.

The famous Liebig, in 1841, rejected the entire theory that plants respire, as based on "a weak and unstable foundation." He considered that the carbon dioxide given off at night was merely that taken in by the plant during the day, but not decomposed because of the absence of the sun's rays. To his great prominence and authority may doubtless be attributed the persistence, even to this day, of erroneous notions concerning plant respiration.

It was Garreau who, in 1851, insisted on the necessity of considering the two processes of respiration and photosynthesis separate and distinct, and this position was afterwards accepted by Sachs, and formulated into a general theory.

I have given only the barest outlines of this history. The battle raged long and fiercely over questions of fact and questions of priority. But, fortunately for the world, the settlement of scientific questions seldom, if ever, depends upon opinion or the majority vote. They are not matters of opinion, and not debatable, but must be settled by direct appeal to nature, through observation and experiment.

C. Stuart Gager.

LEAF BLIGHT OF THE PLANE-TREE.

The plane-trees in the Garden grounds have been seriously attacked this season by a fungous disease which causes the leaves and young twigs to die and change color as though scorched by fire. During the month of June the disease was at its height and the results most conspicuous. It is not confined to this locality, but occurs wherever the plane-tree grows, appearing each season about the time the first leaves are mature. Last year I observed it on the oriental plane in Italy, where the trees usually begin to recover from its attack about the middle of June. A late spring with damp weather is favorable to the growth of the fungus and induces an epidemic of the disease such as occurred here this season.

The fungus (*Gloeosporium nervisequum* Sacc.) was first described by Levéillé in 1848, but was not recognized in this country until nearly forty years afterwards. Three species of plane-tree are subject to its attack: *Platanus occidentalis* and *Platanus racemosa* of North America, and *Platanus orientalis* of the Old World. The active vegetative portion (mycelium) of the fungus lives within the leaves and twigs; the fruiting portion appears in brown patches on the twigs or veins of leaves that have been killed. If one of these brown patches is examined with a lens, a number of dark dots will be found; these dots are small pustules containing numerous minute, colorless, egg-shaped spores, which when mature are distributed broadcast by the wind and communicate the disease to other plane-trees.

The effects of the fungus are usually not lasting except in the case of trees already weakened by disease or starvation. The plane-trees are rendered unsightly for a few weeks, then new foliage appears, and by midsummer all traces of the disease have disappeared. It often happens, also, that many of the branches, especially those near the top of the tree, remain entirely untouched and are able to tide the tree over the period of attack with very little loss.

Not so, however, during a season like the present one, when every tree, in all its branches, appears to be infested with an exceedingly active form of the disease. Leaves, petioles and young twigs have rapidly succumbed to its attacks and young branches

FIG. 21. Western plane-tree, *Platanus occidentalis*, in the Garden ground attacked by leaf blight.

two or three feet long have been found entirely killed by girdling. The dormant buds that develop later will find little nourishment at hand and a short season for growth and preparation for another year; the number of branches already dead will doubtless be considerably increased by the ravages of the winter's cold among unseasoned twigs; and another spring will probably find the plane-trees much less able to cope with the fungus than they were this year. On the other hand, fortunately, the trees will probably have several years to recuperate before another epidemic appears like the present one.

No treatment of the disease can be suggested. Spraying is out of the question because of the immense size of the tree and because the fungus lives within the leaves and twigs and cannot be reached by the spraying solution. It is always desirable to see that the general health of the trees is good and that all dead wood that can be easily reached is removed.

The plane-tree is of little use except for shade. The wood is coarse-grained, difficult to smooth and cannot be split. Of the

FIG. 22. Twigs from the tree shown in Fig. 21. Most of the leaves are attacked.

three North American species, *Platanus occidentalis* is by far the best known. It is one of our very largest trees, occurring in river-bottoms as far north as Massachusetts, and often growing to the height of 100 feet. The oriental plane-tree, *Platanus orien-*

talis, is often met with in cultivation, especially in cities. It differs from our native species chiefly in having smaller and more deeply cut leaves and usually somewhat clustered fruit. It is a native of western Asia and was brought to Europe by the Romans, who, with the Persians and the Greeks, held it in great veneration, planting groves of it and using it for shade about their homes and shrines. The Persian fire-worshippers often held their feasts beneath this tree, as the Druids were accustomed to do beneath the oaks in the forests of northern Europe.

The plane-tree is an excellent shade producer, the leaves appearing at the proper time in this latitude and remaining on the tree as long as could be desired, when they give place to the persistent and graceful fruit. With a little protection it passes the northern winters uninjured and develops rapidly into a splendid and shapely tree large enough for the widest avenues or capable of being adapted by pruning, to which it most readily submits, to very narrow streets. Such is the activity of its young wood and bark that the stem is at times completely girdled without appreciable injury, and the outer layers of its cortex are annually sloughed off during late summer and autumn, leaving the new layers beneath entirely free from soot and dirt accumulated during the summer. It is partly due to this, perhaps, that it enjoys with the *Ailanthus* the distinction of being best adapted to parts of cities where smoke and dust abound.

Plane-trees are comparatively free from either insect or fungous pests, with the exception of the leaf blight. The annual sloughing of the bark is considered by some a drawback to its use on city streets; its foliage is rather late for southern latitudes, but often persists in a healthy condition after that of other trees has succumbed to heat and dust. In some cities of southern Europe complaint is made of the thick hairy covering which becomes detached from the young leaves and twigs and gets into the nose and mouth, producing an inflammation known as "Platanus cough." This tree is, however, most widely and abundantly planted in the cities of India, Persia and Europe, while in America it is deservedly growing more popular as a street tree every year. In London it is considered by many to be the only tree that will thrive in the dirt and smoke of so large a city.

Of the two common species of plane-tree, the eastern is smaller and of closer growth than our native species, though less hardy and less beautiful in form. It was for some time thought, also, that the eastern species was less subject to attack by the leaf blight, but this is probably not the case. In this country the oriental plane-tree is usually preferred, while in Paris the western species is used exclusively, since it seems to conform better to the style of pruning adopted in that city.

W. A. MURRILL.

AN ATTRACTIVE PHILIPPINE SHRUB IN FLOWER.

The shrub from which the accompanying illustration was made has been referred to before in the pages of this Journal. Always beautiful at its flowering period, it has surpassed its former efforts in the magnificence of its display for the past few weeks. This

FIG. 23. An attractive Philippine shrub, *Medinilla magnifica*, in flower in the conservatories of the Garden. This specimen has a spread of twelve feet and a height of seven feet.

shrub, *Medinilla magnifica*, may be seen in the conservatories on the north side of house no. 4, not far from the large plant of *Anthurium Veitchii*. It was originally secured as a small plant through an exchange with Fairmount Park, Philadelphia, in 1900.

The accompanying illustration, in which over fifty flower clusters may be counted, gives no idea of its rich coloring. The leaves are of a deep green, which color serves to intensify the bright pink of the flower clusters, which are sometimes a foot and a half long. Not only the flowers themselves are pink, but the rachis of the cluster and the large bracts are of the same color. It is frequently found in cultivation, but is not often seen so large as this. The plant is well worth a place in any collection, for it is not difficult to grow and flowers often when only two or three feet tall, although to see it in its greatest beauty it should have attained something like the dimensions of this specimen at the garden, which has a spread of about twelve feet and a height of seven feet.

This species was first brought to the attention of horticulturists by the Messrs. Veitch, a famous English firm. It was exhibited by them at the spring meeting of the Royal Horticultural Society in 1850, where it was awarded a large medal, under the name of *M. bracteata*, a Javan species, an error which perhaps gave rise to the statement made in the original publication that the plant was a native of Java. This was later corrected by Hooker, who gave the correct locality as Manila, where it was discovered about 1847 by Mr. Thomas Lobb, a collector sent out by the Messrs. Veitch.

Mr. R. S. Williams, who has spent considerable time in the Philippines collecting plants for the Garden, says that he found it occurring not infrequently in north central Luzon, especially in the neighborhood of Baguio, province of Benguet, where it thrives on the sides of moist shady ravines at an elevation of about 5,000 feet. He describes the shrub as of a straggling habit, broader than high, with a diameter sometimes of twenty feet and a height of eight to ten feet. The specimen in the conservatories, although not so large as this, fits well the above general description, so it may be taken as a characteristic example of this showy shrub in its native home. Mr. Williams secured no specimens of this plant except at Baguio. It has, however, been found by other collectors in the vicinity of the Baco River, in the northern end of the island of Mindoro, about three hundred miles to the south. Its present known range may therefore be taken as indicated above. Data would seem to indicate that in its southern station it grows at a lower elevation than in its more northern home. GEORGE V. NASH.

A COLLECTION OF FOSSIL GUMS.

The Garden has recently acquired an interesting and valuable collection of fossil gums or resins, donated by the firm of G. W.

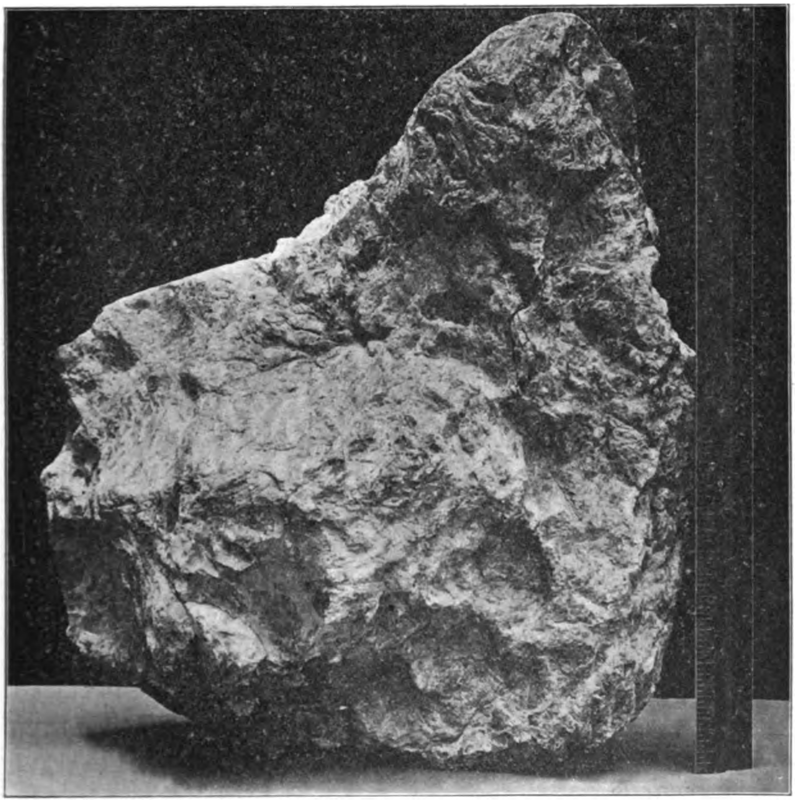

FIG 24 A mass of yellow Kauri, from New Zealand, 17 in. in diameter and weighing 29 lbs.

S. Patterson & Co., 81 Pine St., New York. The specimens include a number of large single masses and several boxes of smaller fragments, all of them representing material utilized in the manufacture of varnish. The largest single piece, weighing about twenty-nine pounds, is shown in Fig. 24, and smaller pieces in Fig. 25.

Such gums are generally known under the rather loosely applied trade names of gum Animé, Copal, Dammar resin and Kauri or Cowrie. They are all natural products of species of trees now living, but the only material used in making varnish is obtained from the ground, in a semi-fossilized condition at the bases of the trees, or in localities where the trees are now extinct.[1]

The Kauries are derived from species of the coniferous genus *Dammara* or *Agathis*; the Copals are for the most part products of leguminous species belonging to the genera *Trachylobium* and

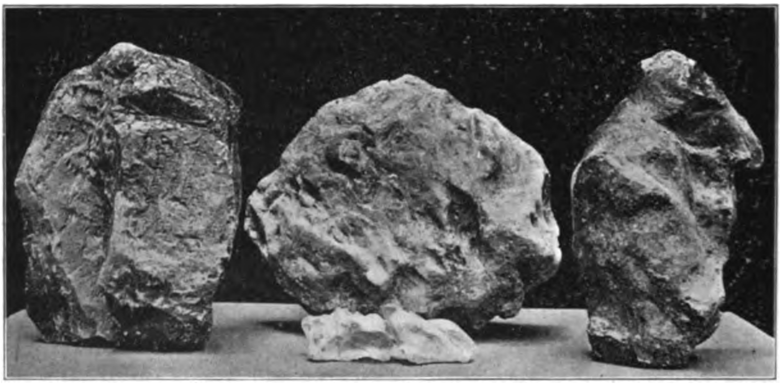

FIG. 25. On the left, a mass of brown Manila copal from Borneo, 8 in. high; in the center, yellow Kauri from New Zealand, 10 in. in diameter; on the right, black Kauri from New Zealand, 8 in. high.

Hymenaea, while the so-called "black-dammar resin" is derived from the burseraceous species *Canarium strictum* Roxb., and the "white dammar" from the dipterocarpaceous species *Vateria Indica* L.

Among the varieties represented in the collection are yellow

[1] A discussion of this subject from a commercial standpoint may be found in the National Standard Dispensatory, pp. 1306–1308. 1905.

and brown Kauri from New Zealand (*Dammara* (*Agathis*) *australis* Salisb.), Dammar resin from Java (*D. orientalis* Lamb.), Copal or gum Animé from Zanzibar (*Trachylobium Hornemannianum* Hayne), white dammar or Manila copal from Borneo (*Vateria Indica* L.), and Brazilian Copal (*Hymenaea Courbaril* L.).

None of the living trees produces such quantities of gum as are frequently represented in these fossil masses and the reason for this extraordinary production in the past has never been satisfactorily explained. Apparently certain conditions favoring the secretion of gum must have prevailed which were different from those of more recent and modern times.

ARTHUR HOLLICK.

NOTES, NEWS AND COMMENT.

Dr. J. A. Shafer and Dr. M. A. Howe represented the Garden at the second annual meeting of the American Association of Museums held at Pittsburg, June 4 to 6.

Dr. W. C. Coker, Associate Professor of Botany at the University of North Carolina, was engaged in cytological research at the Garden during the greater part of July.

Dr. J. E. Kirkwood has recently been promoted to a professorship of botany in Syracuse University, and the botanical work there is now recognized as an independent department of the university instruction.

Dr. M. A. Howe attended the summer meeting of the Vermont Botanical Club at Pownal, Vermont, July 2 and 3. Pownal is in the extreme southwestern part of the state and is celebrated as a botanical collecting ground.

Professor F. S. Earle, formerly in charge of the mycological collections at the Garden and later director of the Cuban Agricultural Experiment Station, is spending several weeks here, continuing his investigations of the gill-fungi.

Dr. N. L. Britton represented the Garden at the fourth annual field Botanical Symposium, held at Newton, New Jersey, July 1 to 8. The region about Swartswood Lake is of great interest botanically and was formerly one of Dr. Britton's favorite collecting grounds.

Dr. Arthur Hollick, Curator, delivered an address at the opening exercises of the St. George branch of the New York public library at Central avenue and Hyatt street, Staten Island, June 26. He also participated in the commencement exercises of Curtis High School on June 27.

Mr. Guy West Wilson (M. S., Purdue University, 1906), who during the past year has been engaged in mycological studies at the Garden, has been appointed professor of biology in the Upper Iowa University at Fayette, Iowa, and expects to begin work there next autumn.

Mr. Fred J. Seaver, university fellow in botany in Columbia University during 1906–'07, has been appointed assistant professor of botany in the North Dakota Agricultural College and assistant botanist of the agricultural experiment station at Fargo, North Dakota.

Miss Winifred Josephine Robinson, Instructor in Biology at Vassar College, has been granted a leave of absence for one year. During this time Miss Robinson will act as Laboratory Assistant at the Garden, and continue her investigations on the taxonomy of the ferns of the Sandwich Islands, the life history of the filmy ferns, and the nutrition of the pitcher-plants (*Sarracenia*).

Professor M. A. Barber, of the University of Kansas, Professor W. L. Bray, of the University of Texas, Professor F. E. Lloyd, of the Arizona Agricultural Experiment Station, Professor F. L. Stevens, of the North Carolina Agricultural and Mechanical College, and Messrs. Hermann Schmidt and Louis Weiss, explorers of the valley of the Amazon, were among recent visitors at the Garden.

Meteorology for June. — The total precipitation recorded for

June was 3.85 inches. The heaviest rainfall (1.88 in.) occurred on June 29–30. Maximum temperatures were recorded of 76° on the 9th; 87° on the 16th; 90° on the 22d; and 91.5° on the 26th; also minimum temperatures of 42° on the 1st and 13th; 44° on the 4th; 59° on the 20th; and 57° on the 28th. The mean temperature for the month was 66.75°.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

8 specimens of mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

15 museum specimens from Montserrat. (Collected by Dr. J. A. Shafer.)

25 specimens of marine algae from the East Indies. (By exchange with Mrs. A. Weber-van Bosse.)

25 specimens of fleshy fungi from Vermont. (Collected by Miss Gertrude S. Burlingham.)

3 herbarium specimens from Canada. (Given by Brother Louis Arsene.)

520 specimens from Egypt. (By exchange with the Botanical Garden, Zurich, Switzerland.)

300 specimens "Plantae Mexicanae." (Collected by Mr. C. G. Pringle.)

10 museum specimens of fossil Kauri, Copal, and Dammar. (Given by Messrs. G. W. Patterson & Company.)

2 specimens of mosses from Massachusetts. (Given by Miss Cora H. Clarke.)

25 specimens, "Ustilagineae" Fascicle 8. (Distributed by H. and P. Sydow.)

4 specimens of *Pinus* from Miami, Florida. (By exchange with the Subtropical Laboratory, Miami, Fla.)

1,667 specimens from the Philippines. (By exchange with the Bureau of Science, Manila.)

1,854 specimens from Colombia. (Collected by Consul Lehmann.)

49 specimens of lichens from Jamaica. (Collected by Professor Duncan S. Johnson.)

PLANTS AND SEEDS.

3 plants for nursery. (Given by Dr. A. Endy.)

1 plant for conservatories. (By exchange with Mr. F. Weinberg.)

88 plants from Panama for conservatories. (Purchased from Mr. Otto Munch.)

1 plant for herbaceous garden. (Collected by Dr. J. A. Shafer.)

30 plants for nursery. (Given by Mrs. Dyer.)

9 plants for conservatories. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

5 plants for nursery. (Given by Mr. O. E. Jennings.)

4 plants for herbaceous garden. (Given by Mr. Quercus Shafer.)

1 plant for herbaceous garden. (Collected by Mr. R. C. Benedict.)

49 plants derived from seed from various scources.

23 plants for herbaceous garden. (Collected by Mr. Norman Taylor.)

2 plants for herbaceous garden. (Given by Miss D. W. Marble.)

6 plants for conservatories. (By exchange with Subtropical Laboratory, Miami, Florida.)

AMERICAN DESERT PLANTS IN THE CONSERVATORY COURT.

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A COLLECTION OF AMERICAN DESERT PLANTS.

In many parts of the world, wherever local conditions are such as to result in a small precipitation, dry arid regions, known as deserts, occur. In America there are many of these. One of them extends from our own southwestern country down through parts of Central America, including the vast region of Lower California. Many of the islands of the Bahamas, as well as many parts of the West Indies, are of this desert character. In South America large desert areas occur on the western slopes of the Andes.

It has been our aim in the past few years to bring together here at the Garden as large a collection as possible of living plants from these arid areas, especially from those of North America. The result has been a collection of desert plants second to none in the country — a collection especially rich in the cactus and orpine families — and it is from this collection that the plants have been selected which fill the large bed in the court of the conservatories. These form only a portion of the entire collection. Many other plants will be found in houses no. 5 and 6 in the conservatories, and a large study collection is grouped in the propagating houses. Many other desert plants from other parts of the world may also be seen in the conservatory houses referred to above. In the court of the conservatories, however, only such plants are to be seen as have originated in the American deserts.

Deserts, or regions subject to long periods of drought and at the best having but a small rainfall, have a vegetation all their own, and the plants which go to make this up are provided with various means by which they can live through these long dry spells. Plants as ordinarily constructed could not survive the extreme conditions which the desert plant is called upon to meet. The perpetuity of such species is insured in a number of ways. In the first place, a great many of the desert plants are annuals, that is, the plant dies, root and stem, after completing its life cycle, depending for the continuance of its kind upon seeds, which it usually makes in great abundance. These seeds lie dormant in the ground until favorable seasons of moisture arrive, when they germinate and make the desert look like a flower garden. This method, of course, is not peculiar to desert plants, but it is one means by which they are perpetuated.

It is, however, among the perennial plants, those which live for several years, that the adaptive methods which make up the characteristics of the desert plants and give to many of them their odd and queer forms are most conspicuous. A glance at this collection of plants in the conservatory court will show how different from most plants they appear. Various methods are resorted to in order to accomplish the same essential end, the storage of nutriment and water to carry them over the drought. Some have the stem much enlarged at the base, as in the huariqui, *Ibervillea Sonorae*, of Sonora. A specimen of this queer member of the watermelon family will be found in house no. 6 of the conservatories. These large bodies lie around in the desert like large knots of wood, with apparently no life in them, but when the rains come they start into growth and send up long green stems which blossom and bear fruit. When the fruit is mature, the stems die down and the plant assumes its dormant condition until the next rainy season. In some cases, as in certain cacti, tubers are made in the ground, which serve the same purpose. In others, the stems and branches, or both, are enlarged and fleshy, and serve as storage organs. This latter condition is found largely in the cactus family. In the hedgehog cactus, *Echinocactus*, it is the stem that is greatly enlarged, often forming globose or cylindric bodies, a foot or more through and several feet high. The capacity of such plants to store water is often taken advantage of by the Indians who inhabit the region where these plants grow. Selecting a large-sized specimen, the thirsty Indian cuts off the top, macerates the pulp within, and squeezes it and drinks the water which it contains. In other plants of the cactus family the stems and branches are composed of flat or cylindric joints, which serve the same purpose. This is especially the case in the genus *Opuntia*, to which the prickly pears belong. Here the large flat joints are often referred to as leaves. This is not true, however, the real leaves being usually very small and inconspicuous. They are to be found on the young shoots only and soon drop away. The stems and branches in these plants act not only as storage organs but also perform the functions of leaves.

In the century plants, which belong to the genus *Agave*, of which many representatives will be found in the center of the bed, the leaves become thick and fleshy and serve as storage organs. This sometimes leads to the plant's own undoing, as man, taking advantage of this storing capacity of the plant, deprives it of its sap, which he manufactures into an intoxicating drink. This is particularly true in Mexico, where century plants are very common; several species are used by the Mexicans in the manufacture of "pulque." Some of the century plants also yield a fiber which is of great value. Sisal hemp, an example of this, is manufactured from the fiber of the sisal plant, *Agave rigida*, which is cultivated in many tropical regions for this purpose. In the orpine family, also, it is the leaves which act as storage organs. A number of species of *Echeveria* and related genera will be found in the bed. In the genera *Dasylirion* and *Beaucarnea* it is the much-enlarged base of the plant which acts as a storage organ.

In all of these plants which have a perennial stem, whether it be the leaves or the stems which are of primary importance to the plant, it will be noted that the epidermis, or outer layer, is so constructed as to prevent the free transpiration of water, thus protecting the plant from the extreme evaporation which would result in the hot sun of the desert — a drain which the plant could not supply from its scanty water supply.

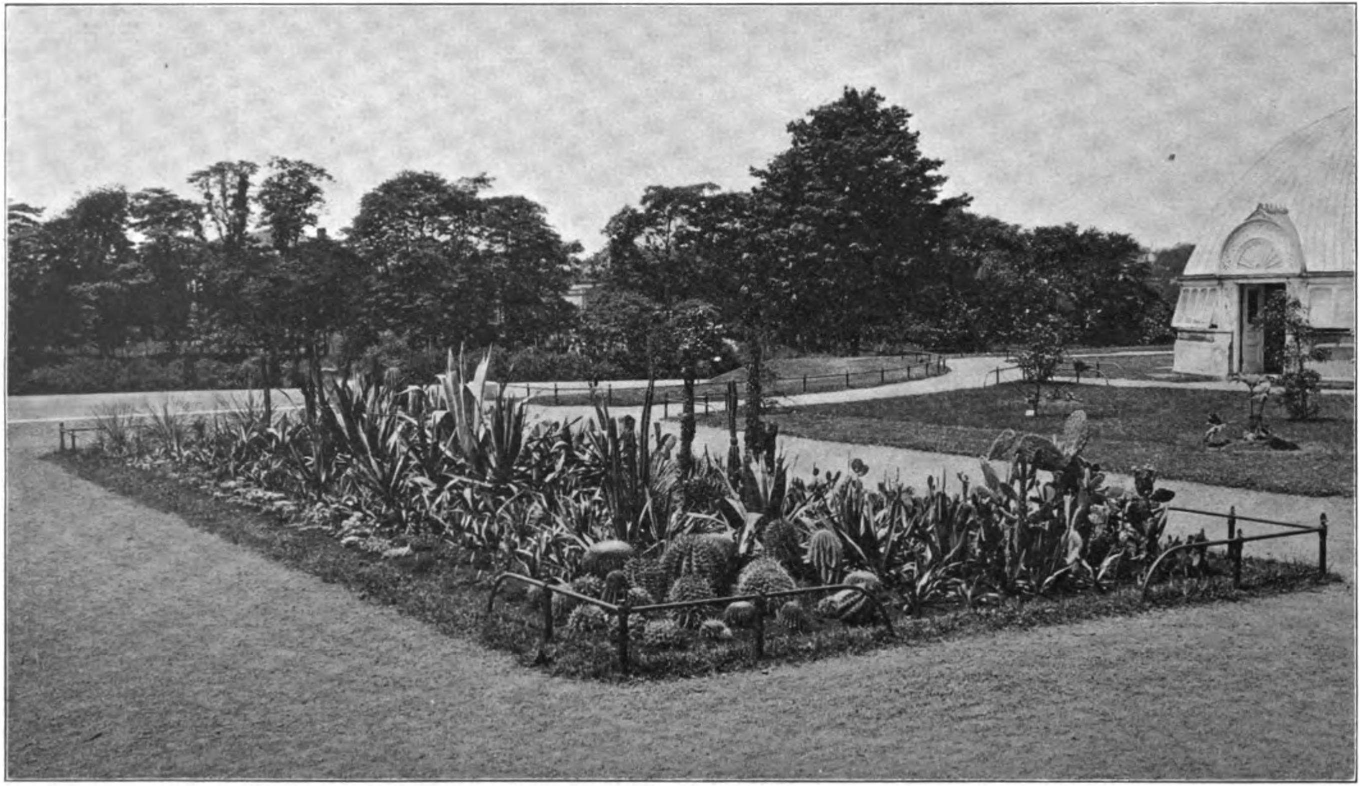

FIG. 26. A collection of American desert plants.

The bed containing this collection of American desert plants is fifty-nine feet long and eighteen feet six inches wide. It contains about five hundred and sixty plants, representing seven families and about two hundred species. The families are arranged as follows: the amaryllis family, to which belong the century plants and furcraeas, is confined mainly to the center of the bed, the furcraeas running out to the border on the northern end. In the center of the bed are a few of the tall columnar cactuses, represented by the genus *Cereus*. A group of these, as well as some species of the genus *Pilocereus*, a closely related group, will be found in the southwestern corner. Conspicuous among these are the saguaro, *Cereus giganteus*, and the rare *Cereus Pringlei*. The western side of the bed is devoted to a group of the prickly pears, the genus *Opuntia*, in both the cylindric and flat-stemmed types. In the northwestern corner are a number of plants of the hedge-hog cactus, *Echinocactus*, already referred to. Here also will be found plants of the turk's-head cactus, *Melocactus*, on two of which will be found the dark-red spiny cap, which gives to the plant its popular name. It is from this portion of the plant that the flowers and fruits appear. On the eastern side of the bed are the members of the orpine family. In the southeastern corner are the members of the lily family, represented by the genera *Yucca*, the Spanish bayonet, *Dasylirion*, *Beaucarnea* and *Hesperaloe*. Near by, in the southern end, will be found a single large plant of the genus *Fouquieria*, which contains five or six species, all American. A small specimen of the desert palm, *Neowashingtonia filifera*, also finds a place here. Two much larger specimens of the same genus, *Neowashingtonia robusta*, will be found in house no. 13, on the north side. The pine-apple family is represented by a plant of the genus *Dyckia*.

George V. Nash.

AN OLD LOCUST POST.

Not far from the eastern boundary of the Garden there is a neglected family burying-ground about one hundred and fifty years old, formerly enclosed by a fence, the posts of which were made of black locust. A single post about four inches thick and a yard high is all that now remains of the fence, and this doubtless owes its preservation to a wild black cherry tree with a forked trunk which has grown from a seed dropped at its base by a passing bird and has for some years enclosed the post and effectually protected it from mechanical injury. This tree is now fifteen feet in circumference at the base and the larger fork is nearly three feet thick, indicating an age of from sixty to a hundred years. During all these years the post has been exposed to the elements, but is still fairly well preserved and will probably last for many years to come.

The black locust, *Robinia Pseudacacia* L., grows naturally from Georgia north to Pennsylvania and west to Iowa, and has been extensively planted and naturalized far beyond its original boundaries. It is abundant about New York City, some of the trees being very old. Early in the seventeenth century it was introduced into Paris by Jean Robin, herbalist of the King, from seeds gathered in Virginia; and in 1636 Vespasien Robin planted a single specimen of it in the Jardin du Roi, which is still alive. In 1753 Linnaeus assigned to this tree the name *Robinia*, in honor of Jean Robin and his son.

There are four species of *Robinia* in the United States, three of which are trees and one a shrub. They are all ornamental, being cultivated for their foliage and flowers. *Robinia Pseudacacia*, the most abundant and best known species, has probably been planted more extensively both in this country and in Europe than any other North American tree. Its foliage is light and graceful, and its conspicuous clusters of flowers, which appear in May and June, are both showy and fragrant. Over thirty ornamental varieties are known.

This species also furnishes an exceeding valuable wood, which is hard, heavy, close-grained, and very durable. It is used for posts, treenails, clubs, bows, fuel, the construction of houses, shipbuilding, street-paving, etc. The durability of its wood is remarkable. The post mentioned above is a proof of this, and many other similar cases might be cited. It is said on good authority that the locust posts used by the early Virginia colonists in the construction of their first rude huts were still standing in a fair degree of preservation a hundred years after they were placed in the ground.

As a shade tree, the black locust is successfully cultivated on the streets of Paris, where the top is kept small and spherical and the branches thickly clustered; in this country, however, it cannot be recommended for shade. It is a rapid grower, hardy, easily propagated and transplanted, and does well in poor soil; but is angular and scraggly in form, with brittle branches, short-lived foliage, unsightly pods, and troublesome sprouting roots; and, moreover, it is often seriously attacked by insects and fungous pests.

The chief enemy of the locust is the locust borer, *Cyllene Robiniae* Forster. This insect riddles the trunk and not only kills the tree but renders the wood unfit for use except for fuel. Another enemy of the black locust is a bracket-fungus, *Pyropolyporus Robiniae* Murrill, the large brown fruit-bodies of which may often be seen in great numbers on the trunks of old locust trees throughout the southern states and as far north as Connecticut. Several insects and fungi attack the foliage of the locust, but the damage they do is usually insignificant compared with that done by the borer and the bracket-fungus mentioned.

W. A. MURRILL.

SOME LITTLE KNOWN EDIBLE NATIVE FRUITS OF THE UNITED STATES.*

There is probably no other center of population in the world where the variety and abundance of fruit is so great as in New York, nor where the supply represents such an elaborate series of systems of production, transportation, storage, and wondrous horticultural arts by which our new varieties are originated and developed. Our citizens may be regarded as epicures in these products. Not only have we at all seasons a liberal variety of fruits to select from, but we have learned to be content with nothing less than the choicest varieties of each.

It is somewhat difficult for such people to even imagine conditions which are easily recalled by those of us who are able to

* From a lecture delivered at the New York Botanical Garden, June 1, 1907.

FIG. 27. An old locust post in the center of a large wild black cherry tree.

look back to a childhood of half a century or so ago, when many of our staple fruits were absolutely unknown in the markets, and when the varieties of those then staple were few and so poor that the best of them would now scarcely find a sale. There were seasons when such common things as apples, oranges and lemons were absolutely unobtainable. The banana came occasionally, to the extent of a few bunches, and might be had at the rate of ten or fifteen cents each, and its tropical associates, now so common, were known only through the accounts of travellers. Many of our present small fruits were either known only in the wild state, or were cultivated merely for a domestic supply. There was no regular trade in them, though the accidental surplus was often marketed, yet as often allowed to go to waste. When we endeavor to picture these conditions to our pampered children, we find it like trying to picture hunger and thirst to one who never experienced them.

It is almost equally difficult for us to realize the relatively worse conditions which faced our early settlers and constituted the *status naturae* of the aborigines. They knew practically nothing of improvements under cultivation, and but little of preserving methods, yet they depended upon the fruit supply, not for their luxuries merely, but to eke out the quantity of food necessary for actual existence. We can, however, readily understand that it would be necessary for a people so circumstanced to eat many things which we would, at first thought, regard as unfit for human food. It is of this class of fruits, particularly, that I wish to speak to-day. The subject is perhaps of more than mere historical interest. Some of these fruits have been pronounced by expert and learned judges to be worthy of a place among our modern supplies, and amenable to great improvement by modern methods of treatment.

We shall first consider a group of fruits of a peculiarly acid character, giving them a semi-medicinal value as antiscorbutics or correctives in addition to that of ordinary fruits. The type of this class is the cranberry, the cultivation of which, scarcely known in my boyhood, is now one of our important agricultural industries. The small cranberry (*Oxycoccus Oxycoccus*) is but little known in this locality, being a plant of northern bogs. The slender stems run through the sphagnum, and the berries, about half as large as those of the cultivated species, lie, usually singly, partly concealed in the moss. These berries are largely collected by the Indians, and are marketed by them in many northern towns. They are very sour, but are preferred by some persons to the common cranberry.

Two fruits are commonly known as "mountain cranberry," one in the southern Alleghenies, the other in nearly all far northern localities and southward in high mountains. Both grow on small erect shrubs instead of on creeping stems like our cranberries. The former is, however, classed as a cranberry (*O. erythrocarpus*). Small is probably correct in maintaining it as a distinct genus, under the name *Hugeria*. Its fruit is small, red to purple, and sour, and is not largely eaten. The other is the well-known mountain cranberry of Europe (*Vaccinium Vitis-Idaea*). It is very largely used, and is a commercial article. It is classed with the blueberries. Its fruits resemble those of the smaller cranberry in size, but are of a deeper red. When fresh they are slightly bitter, but lose this flavor when properly cooked.

Although the discussion of such well-known fruits as blueberries and huckleberries is out of place in this lecture, two members of the group call for special mention. Every berry-gatherer is familiar with a fruit known to country-people as "poison huckleberry," or "green huckleberry." In the books it is mostly called deerberry. We used to know the plant as *Vaccinium stamineum*, but it is now quite properly kept apart from that genus as a *Polycodium*. Contrary to popular belief, there is nothing poisonous about these fruits, which were very generally used by the aborigines. They are not palatable like the blueberry, being sour and slightly bitter, but may be cooked like the mountain cranberry. The other is the so-called southern or mountain gooseberry, of the southern Alleghenies. It is described as especially valuable for cooking and more ought to be known concerning it. Even its botanical identity is in question, though it is probably *Polycodium melanocarpum*.

The two remaining fruits of the cranberry group are not even distantly related botanically with the preceding species. The high bush cranberry (*Viburnum Opulus*) is a close relative of the black haw or nannyberry (*V. prunifolium* and *V. Lentago*). The latter are also sometimes eaten, but are dry, of weak flavor, and palatable only after the action of severe frosts; while the former, the cultivated form of which is our snow-ball shrub, is juicy and acid, and a fair substitute for the cranberry. It inhabits the northern part of the north temperate zone, the world around. Not only was it an article of the aboriginal cuisine but it is still eaten by country-people in northern North America and even gets occasionally into their markets. The fruit of *V. alnifolium* is of very similar appearance but I cannot be certain that it is eaten.

To our ancestors the barberry was the ante-type of our present cranberry, being largely cultivated for its fruit, strongly acid, and of a peculiar flavor, which the cranberry, good as it is, cannot approach. It is probably due to its smaller size and "seedy" character that its use has been so largely abandoned. Nevertheless it has not yet altogether lost caste. Only very recently an old-fashioned friend has informed me that she never fails to procure a supply of this fruit for making a winter preserve that she and her favored acquaintances regard as unequalled.

Very similar to the cranberries, in nature and value, were the native crabapples of this country. The cultivated crabs, though sour enough in the unripe state, have had their acidity much mitigated by cultivation. In their natural condition they were extremely acid, but were stewed and used, not only by the Indians but by generations of settlers, as we use cranberries and pie-plant, as much for their wholesomeness as for their palatability. One of the most valuable properties of this fruit was its permanence after being cooked when unripe, without the addition of sugar. In the northern parts of our southern states these trees were very abundant, often forming dense thickets, like the wild plum. Four native species of this genus (*Malus*) are recognized.

In the arid regions of the west and especially in the far northwest, a substitute for the crabapple is found in the large fruits of some species of rose, notably *R. Nutkaensis.* These fruits are far less acid and more sugary than the crabs, and the "apple" sauce and pies made from them are of the utmost importance to the Alaskans. It is a long step, both botanically and geographically from these to the "apple pies" of the far southwest, made from the Mexican banana, the fruit of the Spanish bayonet (*Yucca baccata*), a plant of the lily family. It is not difficult for any of you to picture this plant in your imagination. Think of the common Yucca of our gardens twice enlarged and much stouter, with leaves ending in spines so stout and sharp that a falling horseman may be impaled upon them, and bearing upon its flower stalk several fruits much resembling in form a stout banana. Between the inner seed capsule and the skin there is a pulp from a quarter to a half inch thick which, when sliced off, may be made into a pie resembling an apple pie of rather weak flavor.

Not all of the fruits used under the name crabapple pertain to the genus *Malus.* The thorn-apple, produced by the enormous genus *Crataegus*, has probably been much more largely used than is known. These fruits are very inferior to the crabs, being dry and of a weak flavor, with a slightly mucilaginous consistency. Nevertheless, the best of them occasionally find their way into the market, and several species have been considerably improved by cultivation. One species is the commonly cultivated "crab-apple" of the city of Mexico and its environs.

The gooseberries and currants, of similar nature to the fruits already considered, can scarcely be classed as little known, yet it will surprise most persons to learn that we have some sixty species of these plants growing wild in the United States, and that in many localities they occur in masses, producing large quantities of delicious fruit. Of the currants, probably the most used sort is the yellow-flowered, tall species, eight to twelve feet high (*Ribes tenuiflorum*), of the southwest. Its fruit is said to be equal to the currants of cultivation. In the northwest occurs a species that produces heavy fruit-racemes six inches or more in length. Of gooseberries, we have two series, one with smooth, the other with prickly fruit. In general, the latter are of richer flavor and would be preferred but for their forbidding exterior and their very thick skins. Like the currants, they are of various shades of green, yellow and red. It may be remarked that several species of the Rocky Mountains (*R. cereum*, *R. inebrians*, etc.) are narcotic poisons.

One of the least known, yet, to the taste of the speaker at least, one of the most delicious of our native small fruits, is the Buffalo berry (*Lepargyraea argentea*). The plant, in many parts of the northwest, and fortunately in partially arid regions, covers square miles of ground, to the exclusion of most else. It produces its one-seeded oblong berries, as large as huckleberries, greenish or pinkish with purple blotches, in the densest profusion. The Indians spread skins beneath the bushes and shake the fruits off by the bushel. During the season they almost live upon them, and they dry great quantities for winter use. The flesh is juicy, sweet and acid, and its flavor may be compared with that of a rich and sweet lemonade. They are prepared in many ways, some of which involve the crushing up of the seed with the pulp. The seed is soft, of not unpleasant flavor, and apparently fatty and nutritious. There are many species of this genus in the northern hemisphere, and a number, even of those cultivated as ornamental shrubs, are delicious. They exhibit a considerable variety of acidity, sweetness and flavor. A related and similar, though larger, fruit is the silverberry (*Eleagnus argentea*), which extends farther north.

Closely related to the crabapples and thorn-apples, but of totally different character from any of the fruits so far considered, are the service-berries, also called June-berries, sugar-berries, shad-berries, and by various other local names. They pertain to the genus *Amelanchier*, now recognized as containing about twenty species. These fruits have the structure of the apple and pear, but the core is thin and soft, so that the entire fruit can be eaten, like a blueberry. The specific determinations of these plants are so obscure that one hesitates to use their botanical names. The one most largely used is the Canadian service-berry (*Amelanchier Canadensis* and probably one or more closely related species). It is a large shrub, and often becomes a small tree. Its fruits are eaten in almost every conceivable form. One of their most important uses is that of being pounded up with chopped meat and the mass frozen for winter use, the "Pemmican" of the Canadians. In the northwest occurs a similar group (*A. alnifolius*, *A. Cusickii*, etc.), regarded as the best and most important fruit of the region. The Canadian Amelanchier is common about New York, where it is known as shad-bush, but it rarely fruits so far south. We have, however, several small shrubby species, like blue-berries, which produce delicious sugary black fruits.

Of our blackberries, raspberries, grapes and plums, I shall not speak, since all are well-known and have contributed important cultivated forms, but there are some important facts concerning aboriginal uses of our native cherries which are not generally known. It may be mentioned in passing that the wild red cherry (*Prunus Pennsylvanica*) so very abundant everywhere to the northward, is far from worthless when well-grown and perfectly ripe. It is rather sour, but yet contains much sugar and is decidedly rich in flavor. Its chief defect is the small amount of flesh in comparison with the large stones. Our common wild black cherry (*Prunus serotina*, but more appropriately separated in the genus *Padus*) has well-known uses in wine making. It is represented in the arid western regions by others with larger fruits, but these consist almost wholly of the large stone, the flesh being so slight in amount and of such poor quality that their use on its account is out of the question. These fruits are largely used by the Indians for the sake of the seeds contained within the stones. To understand this subject, we must recall well-known facts regarding our sweet and bitter almonds. The former is well regarded as one of the most nutritious, wholesome and delicious of our table delicacies. The latter possesses the same constituents, but associates with them substances which, as soon as brought into contact with water, develop prussic acid, not only poisonous, but intensely bitter. The cherries are close relatives of the almond, and agree with the bitter almond in these particulars. The western Indians have learned that water will remove the objectionable substances and leave a very useful food substance; so they pound up these fruits in great quantity, pulp and seeds together, and subject them to an ingenious leaching process, forming the residue into durable cakes for use in time of need.

A far more important cake-making fruit is what might be appropriately called the black checkerberry or wintergreen of the northwest. The limited use of our common red checkerberry (*Gaultheria procumbens*) in the northeast is well-known, the fruit even finding its way, in small quantity, into the New York market. The use of these fruits is very healthful, and mixed with sugar, or even eaten plain, they are quite palatable; yet they are dry and rather insipid. The black one (*G. Shallon*), on the contrary, is sweet, somewhat juicy and of excellent mild flavor. It grows on the northern Pacific coast and adjacent islands, on a bush three or four feet high. These shrubs cover large areas, as do our huckleberry bushes, and produce their fruit in great profusion. It is a staple article of food with the Indians during its season, and the cakes made by pounding it up constitute in some sections almost the sole vegetable food of the winter season. Related to these fruits, and of similar flavor to that of our checker-berry, is the little white teaberry (*Chiogenes hispidula*) of northern regions. It grows on a creeping, matted plant, amidst the moss. The fruit is unimportant, yet constitutes an item in the aboriginal bill of fare. The same may be said of the little partridge berry (*Mitchella*), the special value of which consists in the fact that it can be collected in early spring, upon the melting of the snow. Even the fruit of the little *Moneses* or one-flowered pyrola, is collected by these hard-pressed natives. This is known to us as a very rare and beautiful little bog-plant, but far to the northward it grows freely among the wet sphagnums, and yields sufficient fruit to be worthy of collection.

In the same class of products belongs the little bunch-berry (*Cornus Canadensis*), which can be collected in great quantity in all our northern districts, where the plants grow in great beds. The fruit is a dry, mucilaginous and weakly-flavored drupe, but is not devoid of nutriment.

Let us pass from the consideration of these very small and relatively unimportant fruits to two very large ones, the largest of our wild edible fruits. Their very similar names, papaw and paw-paw, have caused them to be not a little confused in the popular mind. The papaw (*Carica Papaya*) is a distinctly tropical fruit, but has been introduced into southern Florida, where it makes a scanty growth and produces fruit of fair quality. It is a peculiar soft-wooded tree, bearing at the summit an umbrella-shaped crown of huge leaves. At two or three years of age it begins to fruit, and thenceforward produces fruit freely during its life, of from seven to ten years. The fruit has the form and size of a musk-melon, though somewhat pointed. Its pulp is similar and the cavity is thickly covered with rounded black seeds resembling swan shot. The pulp is of peculiar flavor and one must learn to like it, but it is sweet and agreeable. It might be compared in flavor and consistency to an over-ripe and inferior musk-melon. Its great value lies in its high percentage of nutriment and in its power to aid in the digestion of other food eaten with it. When unripe it is irritant and even somewhat poisonous, owing to its milky juice.

The paw-paw is probably to be considered as our richest and most delicious native fruit. Indeed, people are not wanting who esteem it the most delicious of all fruits produced in this country. It is a close relative of the sour-sop, sweet-sop, custard-apple and chirimoya, queen of American tropical fruits. The small tree is abundant in the southern United States, from Arkansas east, and produces its fruits in late summer. Those who know them best say that they should not be eaten until dead-ripe and touched by frost. The fruit resembles a small short and stout banana, but is one-sided and slightly curved. Its seeds, as large as marbles, make bulging points upon its outline, and between them lies the rich, creamy, deliciously sweet pulp. It passes in ripening through the same color changes as a yellow banana. It is common in western and southern markets, and there is a no more needed and promising field for experimentation in horticulture than this remarkable fruit offers.

The fruits thus far considered are mostly of very considerable importance, and not very "little-known." Let us now pass on to consider some which are rather in the nature of curiosities to us, yet important products to those whose general supplies are scanty and poor.

The shallon, which I have described as a very important small fruit of the northwestern tribes, is represented southward by a most distinctly related one, of very inferior quality, yet considerably used for the simple reason that little else is offered over most of the districts where it grows. It is the manzanita (meaning little apple), produced by several species of *Arctostophylos*, especially by *A. pungens*. They are very interesting and beautiful shrubs, with pale-green or glaucous evergreen leaves and terminal clusters of reddish-yellow fruits. The latter are apple-shaped, but scarcely exceed a half inch in breadth, and are usually more or less grooved from base to summit. They are rather dry and sour, and quite astringent, but cooking renders them sufficiently palatable to the Indian. They are also pounded up with other substances to form cakes for preserving.

The apple family itself supplies a similarly used fruit, the California holly (*Heteromeles arbutifolia*), in southern California and adjacent Mexico. It is closely related to our mountain ash (*Sorbus*), and is a very handsome plant. The shrubs grow thickly and exhibit dense masses of dark and glossy foliage, against which lie the large clusters of rich crimson fruit. The latter is not very astringent, but bitterish, and it would be difficult for any of us to class it as edible, yet its use is not unimportant to those impoverished people. The closely related choke-berry or choke-pear (*Aronia arbutifolia*) performs a very similar rôle for the eastern tribes. This small and more slender erect shrub is everywhere common along the Atlantic and very abundant in many sandy salt-marshes, and all berry-pickers are familiar with it. The fruits are of a rich glossy purple-black and much resemble our large black huckleberry. They look very tempting, but are found to be flat and puckery in taste.

The very puckery properties of the unripe persimmon, and its sweet and edible properties when thoroughly ripe, are too well-known to require more than mention, but reference may be made to the extensive use of another very astringent fruit, the sumac-berry, produced by various species of *Rhus*. Its use for the preparation of an acid, refrigerant drink, when nothing else is obtainable for the purpose, has been handed down to the present day. The Indians also pound it up into cakes, for use as a food. It is not unlikely that the nutrition of the contained seeds has much to do with this use.

An even stranger fact is the use by the northern Indians of cakes made by pounding up soap-berry (*Sapindus*). This fruit, as large as a marble, consists of a thin, translucent, gummy, wrinkled pericarp, of red or orange color, loosely enclosing a single large hard seed. The pulp is not only acrid, soapy and unpalatable, but contains considerable saponin, a distinctly poisonous constituent, and one can but wonder at its use. Quite a number of vegetable substances containing saponin are used as Indian foods, but always after some leaching process for the removal of this constituent.

A fruit that reminds us much of the soap-berry in its appearance is the saw-palmetto of our southeastern coast region, where it is produced in prodigious quantity. Its properties are, however, very different. Although it leaves an acrid taste after free eating, it is sugary and nutritious. It is used in large quantities for fattening hogs and chickens, and it was formerly eaten to a considerable extent by the natives.

A northern visitor to our south Atlantic resorts looks with curiosity upon the use of the fruits of the passion-flower, known as may-pops, but people from the tropics are familiar with the use of a number of related species, some of almost sickish sweetness, others as acid as the lemon. This fruit is elliptical and as large as an egg. It has a crustaceous rind, like a mock-orange gourd, which, when stepped upon, emits a popping sound, whence the common name. The interior is a mass of translucent, slippery pulp, clinging tenaciously to a large number of small seeds. It is commonly eaten by swallowing the mass entire, like an oyster.

Unfortunate is the modern lover of fruits who has not access to a supply of our native eastern black mulberry (*Morus rubra*), one of the most highly esteemed, and justly so, of aboriginal fruits. This tree, when well grown in an open space, is widely spreading and thickly clothed with large leaves, making it an admirable shade tree. In early July it is loaded with deep purple-black fruits nearly an inch in length and about as thick as the little finger, full of rich purple juice, and so tender and soft as to be scarcely marketable. They are highly esteemed by most persons, though of too heavy a flavor for some. The European mulberry, much cultivated, is not to be compared with this. Southwestward we have several smaller, less juicy, and in every way inferior species.

A group of fruits not nearly as well known as they should be are those produced by many of our southwestern *Cactaceae*. Some of these are very small, no larger than the sharpened end of a lead pencil, and of similar form. It is probably for this reason that they are not better known, for some of them are really excellent. Many, even among those of larger size, are sour, slimy or "flat," and would not commend themselves to the civilized taste; but a few are large, well-flavored and highly nutritious, and are not only among the most important of Indian foods, but have been highly valued by all travelers who have become familiar with them. The most important of them is the pitahaya of the Apaches, produced by a large columnar cactus, *Cereus Thurberi*, of Arizona and northern Mexico. The fruit is of the form and size of an orange, green externally, containing a rich crimson-scarlet pulp with innumerable small, imbedded seeds. This pulp is sugary, juicy, rich and well-flavored and is the cream of Indian existence during the late summer, when they subsist almost entirely upon it. While the pulp is the flavored portion, the seeds are more important, owing to their highly nutritive qualities. This fruit is cooked and preserved in many ways, and from it are made both syrup and alcoholic beverages. The famous giant cactus of Arizona (*C. giganteus*) produces the saguaro, a fruit similarly used. It is elliptical in form, and the pulp is of a deeper crimson. The facts stated suggest the use of the fruits of the common prickly pear cactus of the Atlantic coast. These small, yellowish, shriveled fruits, about as large as plums, are rather dry, mucilaginous and insipid, except for their mild acidity, and we do not find them palatable. Nevertheless, history records their use, by both aborigines and settlers. They were usually stewed and strained into a mass much resembling apple-sauce.

A fruit much more agreeable to the civilized palate, though of a peculiar flavor that is as objectionable to some as it is esteemed by others, is the ground-cherry, husk-tomato, or cherry-tomato, produced by various species of *Physalis*, in the tomato family. There is a wide variation in sweetness and flavor among the several species. The best is produced by the very sticky plant that we know botanically as *P. viscosa*. The plant grows in sandy soil near the coast, rarely reaching a foot in height, but spreading out to twice that breadth. It bears an ovoid, pointed husk an inch or more long, inside of which is a yellow, sticky, sweet berry. It is ripe in the late blackberrying season, when it is much sought by children, and is relished by adults. It reminds us slightly in its flavor of the much larger berry of the mandrake, or may-apple, a rather well-known fruit also often eaten, though scarcely to be called good.

The elderberries are also fruits of a peculiar strong flavor, objectionable to many people. Their use for making wine is very familiar, and this wine is a very superior article. Their use in pie-making is also quite well known, but their former very extensive use as a food among the savages is a historical fact not commonly recognized. There are quite a number of species in America, black, red and even blue in color, and all seem to have been employed. A fact more difficult for us to realize is the use, apparently never extensive, of the wax-berries (*Symphoricarpos*), and the fruits of various species of honeysuckle, both reputed as somewhat poisonous.

My lecture should include an account of a number of interesting semi-tropical fruits growing along our southern borders, from Texas eastward, including the sea-grape (*Coccoloba*), the cocoa-plum (*Chrysobalanus*), the downward plum (*Bumelia*), and fruits of the genera *Condalia*, *Zizyphus*, *Forestiera*, *Cordia*, *Ehrectia* and *Celtis*. The qualities and uses of most of these fruits are, however, very little known as yet and I will content myself with having exhibited these pictures and made reference to them.

H. H. Rusby.

THE ECONOMIC GARDEN.

In the May JOURNAL reference was made to the new Economic Garden then in process of installation. Since that time much has been done in the development of this feature. Many of the more common economic plants are now represented, and the collection has been labeled. Each bed is furnished with a large sign indicating the general nature of the contents, and each plant in the bed is supplied with a smaller individual label giving useful information in regard to that particular plant.

Through the center of the tract devoted to this garden is a broad aisle of sod about thirty-two feet wide, at the southern end of which is a pool; from this pool flows a narrow brook running the length of the valley to the southern end of the Herbaceous Grounds, with several widenings here and there in the shape of small pools.

To the east of this aisle are the beds containing the plants from which are derived fibers, medicines, condiments and relishes. The bed containing the fibers is the most southern one, and is not far distant from the pool referred to above. Here will be found some of the plants which furnish important fibers, such as cotton, linen, ramie, and jute. Following this are several beds devoted to medicinal plants. In these will be found, among others: foxglove and aconite, both valuable remedies in heart troubles; rhubarb; belladonna; licorice; tobacco; dulcamara; castor-oil plants, from the seeds of which is extracted the well-known castor-oil; coltsfoot; wormwood, which is used in the manufacture of absinthe; horehound; stramonium, with its poisonous leaves and seeds, which is known under a variety of common names, such as devil's apple, mad apple, apple of Peru, devil's trumpet, and Jamestown weed, from which last has arisen the corruption Jimson weed; catnip; pennyroyal, from the leaves and flower-tops of which is obtained the oil of pennyroyal; tansy; eupatorium, or boneset; valerian; and conium, or poison hemlock.

Among the shrubs lining the woodland border will be found a number of medicinal plants familiar to many. Among these are: *Hamamelis Virginiana*, from which is obtained the common and

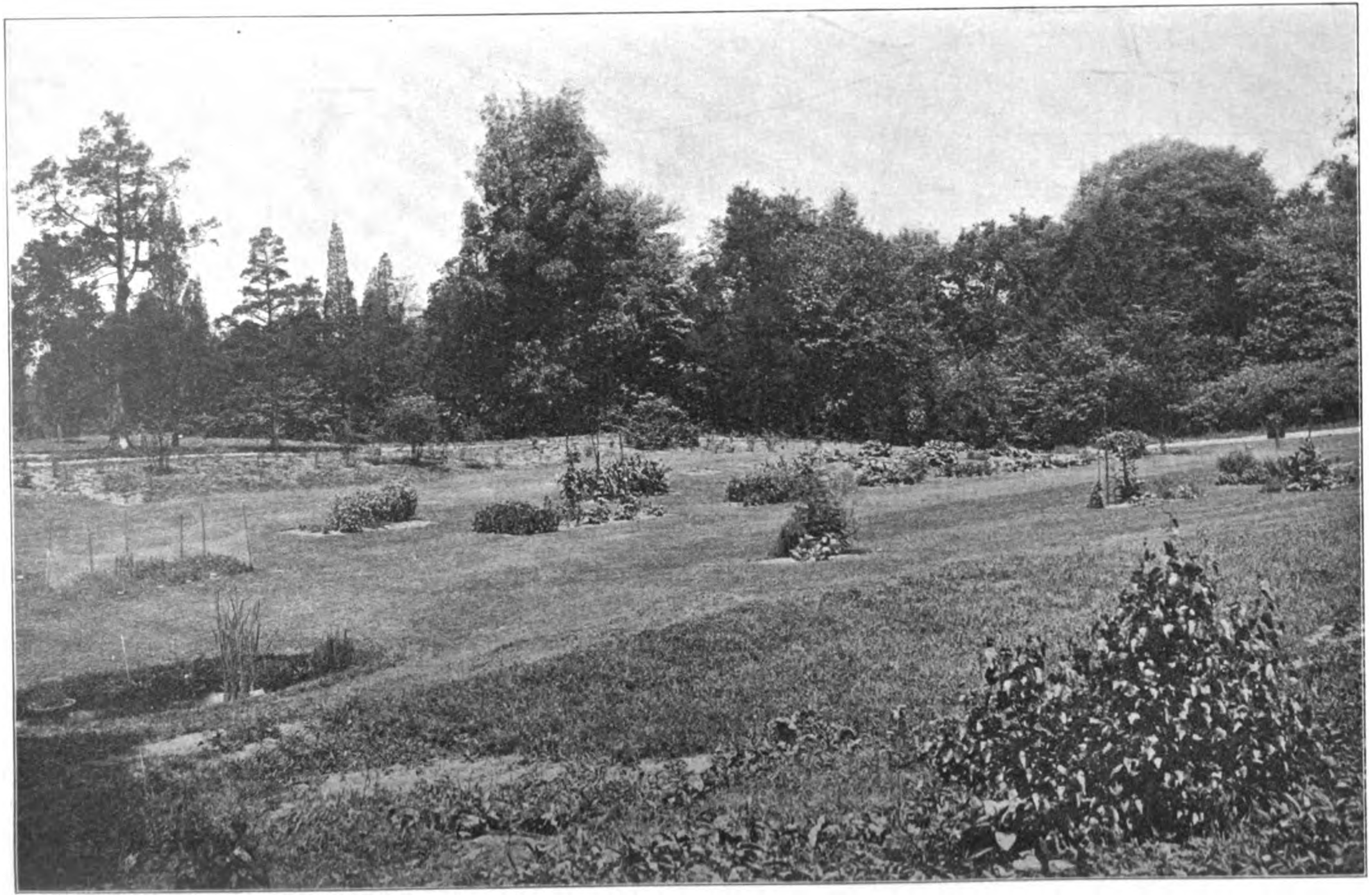

FIG. 28. A view of the economic garden, looking northwest.

popular remedy known as witch hazel or Pond's extract; prickly ash, *Xanthoxylum Americanum*, also known as the toothache-tree and Angelica-tree; *Rhamnus Frangula;* ceanothus, belonging to the same family as the *Rhamnus*, and sometimes known as New Jersey tea and red-root; hydrangea; and the shrubby yellow-root. Along the brook referred to above will be found additional medicinal plants, such as sweet flag and magnolia, placed there on account of the moisture which they require.

At the extreme northern end of the series is a bed devoted to condiments and relishes. Here will be found such old and well-known plants as lovage, fennel, lavender, thyme, sage, spearmint, nasturtium, mustard, horse-radish, anise, marjoram, savory, balm, and caraway. In the brook will be found the common water cress, *Roripa Nasturtium.*

To the west of the grass aisle are the food plants. Here are plants which furnish some of our most well-known foods. These have been grouped according to the part of the plant which is used. Three of the beds are devoted to such plants as furnish roots, tubers, corms or bulbs for food, or, in general, those in which the underground parts are used. Among these may be mentioned the potato, onion, leek, yam, oyster-plant, beet, carrot, radish, turnip, parsnip, sweet potato, and Jerusalem artichoke. To plants in which the stems or leaf-stalks are used a single bed is allotted. Here will be found such common food plants as asparagus, celery, rhubarb, kohl-rabi, and sea kale. The leaves of many plants are used for food; to such plants two beds are devoted. Some of the commonest vegetables belong here, such as cabbage, kale, Brussels sprouts, parsley, lettuce, spinach, dandelion, and chicory. A small bed is devoted to such plants as furnish edible flowers, represented here by broccoli, globe-artichoke, and cauliflower. To such plants as produce fruits, eleven beds are allotted. Here many of our commonest foods will be found, such as the egg-plant, tomato, okra or gumbo, peppers, squash, pumpkin, cucumber, muskmelon, citron, and watermelon. Some of these, as for example the tomato and egg-plant, may not be popularly known as fruits, but they are strictly so, for a fruit is a product derived directly by growth from the flower. These are usually classed among the vegetables, a term of broader scope than the term fruit.

To grains and seeds are given four beds. Some of the common cereals are planted here, including wheat, rye, and barley. Among other well-known plants in which the seeds are used for food are buckwheat, beans, lentils, peas, sweet corn, pop corn, and peanuts. To fodder plants, in which the herbage is used, are given two beds. Here will be found such well-known plants as white clover, red clover, crimson clover, alfalfa, spring vetch, winter vetch, timothy, red-top, Kentucky blue grass, and field corn.

In the collection of shrubs between the beds and the westerly path are a number of plants which produce foods of various kinds. Here will be found, among the nuts, the chinquapin, the filbert and the American hazel-nut. Among the berries will be found the currant, both red and white, the huckleberry, and the blueberry. There are other kinds of fruits which are popularly called berries, but which are not. To this class belong the strawberry, the blackberry, and the raspberry, all of which are represented here. A fruit of this kind is known as a compound fruit, for it is made up of several smaller fruits, each the product of a developed ovary in the flower. In the strawberry it is the receptacle on which these ovaries are placed which enlarges and furnishes the luscious flesh of that fruit, the seeds appearing as the small yellowish objects on or near the surface. In the blackberry each of these seeds is enclosed in a juicy covering, a collection of these forming the so-called berry. The receptacle in the best blackberries is also enlarged, so that there are two elements of food in such fruits. In the raspberry, as is well known, the receptacle remains on the bush when the fruit is picked, so that only the seeds surrounded by the juicy coverings are used.

Some of the food plants will be found along the brook. The taro, *Colocasia esculenta*, is one of these. It is a member of the family to which our common jack-in-the-pulpit belongs, and like it has a corm. It is this part which is edible and is used in tropical regions, including the West Indies, very much as the potato is used in temperate regions. Rice, *Oryza sativa*, will be found growing in the small pool referred to above. This is largely grown in our own southern states, and also in immense quantities in Asiatic countries, where it is the staple article of food. Near this is a clump of the wild or Indian rice, a native of North America. It grows in swamps, and in some places covers large areas. It is of frequent occurrence on the Hackensack marshes in the neighborhood of New York City, and in other places of similar nature. It was largely used by the Indians for food.

There are at present in the Economic Garden thirty-one beds. In these, and along the brook and in the shrub borders, are contained about two hundred and thirty different kinds of economic plants, classified as follows: food plants, one hundred and forty; fibers, six; medicinal, sixty-five; condiments and relishes, eighteen.

GEORGE V. NASH.

REPORT OF LECTURES ON THE PRESERVATION OF WILD FLOWERS.

NEW BRIGHTON, NEW YORK CITY,
August 2, 1907.

DR. N. L. BRITTON,
Director-in-chief, New York Botanical Garden.

Dear Sir: Upon receipt of your letter of May 9 last, authorizing a grant to me of $200 from the Stokes' Fund to be used in defraying the expenses of a lecture tour in aid of the cause of plant protection, I proceeded to New York, and, after making a selection at the Garden of about fifty colored lantern slides from the Van Brunt collection, continued to Summit, New Jersey, from which place an invitation to lecture had been several times extended me by Mrs. Georgiana K. Holmes, founder and secretary of the Nature Study League. Bad weather and a local Board of Trade dinner on May 10, the evening of the lecture, interfered somewhat with the attendance, but the interest displayed by the school children, many of whom spoke to me after the lecture, was very gratifying.

On May 11, I went to Nantucket, where a day was spent walking about the island and observing the interesting flora of the sandy prairies and scrub pine groves. The mayflower is here the most abundant of spring wild flowers, carpeting the moors on the south side of the island and lending a rich, spicy fragrance to the ocean breezes that sweep over these exposed tracts. It is in less danger from picking than from the surface fires which are of common occurrence in spring. These fires, kindled chiefly through carelessness or accident, run rapidly over the dry vegetation of the moorlands, but fortunately do no lasting damage. The later blooming wild flowers suffer more or less at the hands of summer tourists, but I was glad to observe that the residents of Nantucket as a whole are keenly alive to the importance of preserving the natural beauties of the island, and carefully guard the localities for many rare plants, especially the Scotch heather and the two European heaths (*Erica cinerea* and *E. tetralix*) which occur there. I lectured May 13 in the historic old Unitarian church to a large and appreciative audience, every possible courtesy being extended by the pastor, Rev. Edward Day, and by Principal B. D. May of the High school.

The following day I left for Boston, lecturing there in the rooms of the Boston Society of Natural History under the auspices of the Society for the Protection of Native Plants by invitation of its president, Professor Robert T. Jackson of Harvard University. The talk there was rather in the nature of a comparison of the work of the two Societies, the relations between which have always been of the most cordial nature. There can be no doubt that the large population of Boston and its environs has been greatly enlightened on the subject of plant protection by the many excellent leaflets distributed by our sister organization.

I then went to Springfield, where several days were spent visiting friends, resuming my tour May 22 with a lecture at Brattleboro, Vermont, in the Baptist church, under the auspices of the Young People's Society. On May 23 I addressed a large audience in the music hall at Woodstock, where the preliminary arrangements had been kindly made by Mr. and Mrs. Franklin S. Billings. On May 24 I spoke in St. Johnsbury in the attractive Fairbanks Museum, whose curator, Miss Delia Griffin, is keenly alive to the importance of plant protection, and is doing an excellent work among the school children. May 25 I reached Burlington, where Professor L. R. Jones of the University of Vermont, one of our own members, had made all arrangements for the lecture in the science hall of the university. The attendance here was one of the largest that the hall has contained, and several new members were enrolled. I remained three days in Burlington as the guest of Professor Jones, visiting points of botanical interest, and on May 29, at the invitation of President Brainerd, spoke in the chapel of Middlebury College at Middlebury, enjoying afterwards the privilege of inspecting his wonderful violet garden.

May 30 I left for Ottawa, where I was hospitably received by Mr. J. M. Macoun, of the Geological Survey, and entertained that evening by the Ottawa Naturalists' Field Club, under whose auspices the lecture was given the following evening in the Normal School, with a large attendance. June 1 I spoke at the University of Toronto, in Toronto, through the courtesy of Professor R. Ramsay Wright, enrolling more new members for the Wild Flower Preservation Society here than in any other place. Indeed, my experience in Ottawa and Toronto indicates that the people of Canada are fully as interested in this subject as those of our own country, and suggests the advisability of an extended tour among the smaller cities of Canada at some future time.

I had expected to lecture in Montreal, but owing to the disasters by fire which McGill University has recently sustained, it was thought advisable by Professor Penhallow to defer it. My tour came to an end June 6, when I spoke at the Murdock school in Winchendon, Massachusetts, with a large attendance of school children.

Although the total number of new members gained for the Wild Flower Preservation Society is not, perhaps, as large as might have been expected, I consider that the tour has been highly successful from an educational point of view. The leaflets printed by the Society and the linen posters issued by the Garden have been widely distributed, and an effort has been made in each locality to indicate the specific line of work that is most required.

It seems to me that we may already detect evidences of success in our campaign for plant protection, and that we may look forward to more important accomplishments in the future.

Respectfully submitted,

CHARLES LOUIS POLLARD,

Secretary-Treasurer,

Wild Flower Preservation Society of America.

NOTES, NEWS AND COMMENT.

Dr. and Mrs. N. L. Britton will sail for Jamaica August 24.

Professor F. S. Earle returned to Cuba August 10.

Mr. W. R. Maxon spent several days at the Garden during July and August studying the fern collections.

Mr. Charles L. Pollard has recently been appointed Curator of the Staten Island Association of Arts and Sciences. He will be located in the new Richmond Borough Building, to which the collections belonging to the Association will shortly be moved.

Dr. H. H. Rusby, Curator of the Economic Collections, has recently been appointed official expert in drug products to the United States Government, his chief duties being to determine whether or not importations are true to name and suitable for use in medicinal preparations. Dr. Rusby has for nearly two years occupied a similar position with the Department of Health of this city, in which the drugs and medicines sold here were tested and passed upon by him as to quality.

Among recent visitors at the Garden were Professor Douglas H. Campbell, of Stanford University, California; Dr. H. N. Whitford, of the Bureau of Forestry of the Philippine Islands; Dr. C. D. Howe, of the Biltmore School of Forestry, North Carolina; Dr. D. T. MacDougal, of the Carnegie Institution of Washington; Professor and Mrs. T. D. A. Cockerell, of Boulder, Colorado; Dr. J. McK. Cattell, of New York; Professor Duncan S. Johnson, of the Johns Hopkins University; and Professor William Bateson, of the University of Cambridge, England.

Mr. Samuel Henshaw, who served for some years as head gardener of the New York Botanical Garden, died on Staten Island on July 16. Mr. Henshaw was active in the preliminary work of developing the Garden, and was employed in 1895 to oversee the planting of a temporary nursery on the east side of the grounds near the site of the present nursery, and in 1896 did the preliminary planting of a portion of the border screen along the New York Central and Hudson River Railroad near the station. He was appointed head gardener in 1897 and served until the end of 1900, at which time he resigned. He served on the Commission of six experts appointed by the Board of Managers on July 17, 1896, to prepare a general plan of development of the grounds, this report having been submitted to the Board of Managers November 30, 1896, and approved December 14, 1896. In 1901 he was commissioned to proceed to the West Indies to obtain specimens of living plants for the conservatories.

Meteorology for July. — The total precipitation recorded for July was 1.66 inches. The heaviest rainfall (0.51 inch) occurred on July 2. Maximum temperatures were recorded of 88° on the 2d; and 93° on the 8th, 18th, and 25th; also minimum temperatures of 55° on the 3d and 13th; and 59° on the 21st and 26th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM JUNE 1 TO AUGUST 1.

ANDREWS, H. C. *The heathery; or a monograph of the genus Erica.* Ed. 2. London, 1845. 6 vols.

COMERE, JOSEPH. *Les desmidiées de France.* Paris, 1901.

DAUBENY, C. *Essay on the trees and shrubs of the ancients.* Oxford, 1865.

DE VRIES, HUGO. *Plant breeding; comments on the experiments of Nilsson and Burbank.* Chicago, 1907.

FARLOW, W. G. *On some impurities of drinking-water caused by vegetable growths.* Boston, 1880.

GAUTIÉ, ALBERT. *Les théories et les applications nouvelles de la greffe.* Paris, 1907.

HAMPEL, W. *Die moderne Teppich-gärtnerei.* Siebente Auflage. Berlin, 1907.

HANDEL-MAZZETTI, HEINRICH FREIHERR VON. *Monographie der Gattung Taraxacum.* Leipzig. 1907.

JOHNSON, CHARLES. *British poisonous plants.* London, 1856.

JOST, LUDWIG. *Lectures on plant physiology.* Authorized English translation by R. J. Harvey Gibson. Oxford, 1907.

JUNK, WILHELM. *Carl v. Linné und seine Bedeutung für die Bibliographie.* Berlin, 1907.

KLEBS, GEORG. *Über künstliche Metamorphosen.* Stuttgart, 1906.

KLÖCKER, ALB. *Fermentation organisms;* a laboratory handbook, tr. from the German by G. E. Allan and J. H. Millar. London, 1903. (Deposited by the Trustees of Columbia University.)

KNAPP, F. H. *Botanical chart of British flowering plants and ferns.* Bath, 1846.

KRAEMER, HENRY. *Text-book of botany and pharmacognosy.* Philadelphia, 1907. (Given by the Torrey Botanical Club.)

LAING, R. M., & BLACKWELL, E. W. *Plants of New Zealand.* Christchurch, 1906.

LOUDON, JANE. *The ladies' flower-garden of ornamental greenhouse plants.* London, 1848.

Maryland Geological Survey. Baltimore, 1907. 4 vols. (Given by Dr. Arthur Hollick.)

MENZEL, P. *Über die Flora der Senftenberger Braunkohlen-Ablagerungen.* Berlin, 1906. (Given by Dr. Arthur Hollick.)

MOLISCH, HANS. *Die Purpurbakterien nach neuen Untersuchungen.* Jena, 1907.

MÜLLER, GUSTAV. *Mikroskopisches und physiologisches Praktikum der Botanik für Lehrer.* Leipzig, 1907.

MYRICK, HERBERT. *Sugar: A new and profitable industry in the United States.* New York, 1897. (By exchange with the Library of Congress.)

NEWMAN, JOHN B., ED. *Illustrated botany.* New York, 1846.

SCHLEIDEN, M. J. *Die Pflanze und ihr Leben.* Sechste Auflage. Leipzig, 1864.

SCHWARZ, G. FREDERICK. *The longleaf pine in virgin forest.* New York, 1907.

SELBY, PRIDEAUX JOHN. *History of British forest trees.* London, 1842.

SMEE, ALFRED. *The potatoe plant, its uses and properties.* New York, 1847.

SMITH, JOHN. *Historia filicum; an exposition of the nature, number, and organography of ferns.* London, 1875.

SMITHSONIAN INSTITUTION. *Annual report of the board of regents of the Smithsonian Institution.* Washington, 1854–93. 27 vols. (Given by the Smithsonian Institution.)

WEISMANN, AUGUST. *Ueber den Einfluss der Isolirung auf die Artbildung.* Leipzig, 1872. (Given by Dr. J. H. Barnhart.)

WILBRAND, J. B. *Die natürlichen Pflanzenfamilien in ihren gegenseitigen Stellungen.*
Giessen, 1834. (Given by Dr. J. H. Barnhart.)

ZAHN, KARL HERMANN. *Die Hieracien der Schweiz.* Zürich, 1906.

MUSEUMS AND HERBARIUM.

20 specimens of ferns from Staten Island, New York. (Given by Dr. Philip Dowell.)

100 specimens of fungi from the Philippine Islands. (Given by Mr. A. D. E. Elmer.)

63 specimens of mosses from Japan. (By exchange with Mr. J. Cardot.)

86 specimens of flowering plants from Cuba. (Given by Professor F. S. Earle.)

1 specimen of *Rhododendron catawbienese* from eastern North Carolina. (Given by Professor W. C. Coker.)

26 specimens of mosses from Jamaica. (Collected by Miss Clara E. Cummings.)

6 specimens of Hepaticae from Vermont. (Given by Miss Annie Lorenz.)

30 colored drawings of fungi. (Given by Mrs. F. S. Earle.)

50 specimens "Uredineen," fasc. 42 and 43. (Distributed by Drs. H. and P. Sydow.)

360 specimens from Cuba. (Collected by Mr. W. R. Maxon.)

15 specimens of mosses from Jamaica. (Given by Professor D. S. Johnson.)

4 specimens of mosses from Costa Rica. (By exchange with Mr. J. Cardot.)

3 specimens of *Fomes roseus* from Newton, New Jersey. (Collected by Dr. N. L. Britton.)

6 specimens from the vicinity of Philadelphia. (Given by Mr. S. S. Van Pelt.)

1 specimen of *Phytophthora Phalictri.* (Given by Mr. Guy West Wilson.)

228 specimens from California. (Collected by Mr. A. A. Heller.)

18 specimens of North American Peronosporales. (Given by Mr. Guy West Wilson.)

60 specimens of mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

PLANTS AND SEEDS.

17 plants for conservatory pools. (Purchased.)

3 plants for conservatory. (Given by Mr. V. E. Rix.)

1 plant for conservatory. (By exchange with United States National Museum, through Dr. J. N. Rose.)

8 plants for conservatory. (Given by Miss Helen M. Gould.)

9 plants for conservatory. (Given by Mr. E. F. Cabada.)

27 plants for nursery. (Collected by Mr. R. C. Benedict.)

1 plant for nursery. (Given by Mr. P. H. Dowell.)

84 plants derived from seed from various sources.

VIEW IN THE NATURAL POND.

The margin is fringed with native plants, including the pickerel weed, elderberry, and asters.

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AUTUMN LECTURES, 1907.

To be delivered in the lecture hall of the museum building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows:

Oct. 5. "The Salton Sea and its Effect on Vegetation," by Dr. D. T. MacDougal.

Oct. 12. "Collecting Fungi in the Wilds of Maine," by Dr. W. A. Murrill.

Oct. 19. "The Forms and Functions of Leaves," by Dr. C. Stuart Gager.

Oct. 26. "The True Grasses and their Uses," by Mr. George V. Nash.

Nov. 2. "The Giant Trees of California: Their Past History and Present Condition," by Dr. Arthur Hollick.

Nov. 9. "The Progress of the Development of the New York Botanical Garden," by Dr. N. L. Britton.

Nov. 16. "Edible Roots of the United States," by Dr. H. H. Rusby.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5:33 train from the Bronx Park railway station, arriving at Grand Central Station at 6:02 P. M.

The Museum Building is reached by the Harlem Division of the New York Central and Hudson River Railway to Botanical Garden Station, by trolley cars to Bedford Park, or by the

Third Avenue Elevated Railway to Botanical Garden, Bronx Park. Visitors coming by the Subway change to the Elevated Railway at 149th Street and Third Avenue.

WATER LILIES AND OTHER AQUATICS: THEIR RELATION TO HORTICULTURE.*

Why is it that aquatic gardening is not more frequently resorted to in landscape effects? Is it the fear that it may involve too great an expense, or that it may be difficult to secure plants for the purpose? In this as in many other things you can spend money, and plenty of it too, in developing a water garden, but beautiful results may be obtained with a comparatively small outlay of money, for many of the plants may be secured in the immediate neighborhood, the only expenditure necessary being one of time and patience. There are so many spots, now unsightly or adding but little to the beauty of the surroundings, that could be so vastly improved by even a little care in planting, that it seems incredible that they should be allowed to remain as they are. Many an old swamp or bog, or a pond or lake with unsightly shores, may be turned from a dreary waste of weeds and tangle into a thing of beauty, awaiting but the touch of the artistic hand to effect this transformation. Here may be found many plants, called weeds in their uncultivated condition, which, if but transplanted and given a chance, will respond quickly and well repay the care and attention bestowed upon them. This is the height of the horticulturist's art — to remove the enemies and unfavorable conditions, thus allowing each plant to tell its own story in its own way and bring its message to mankind.

With the site in view, the question arises, how shall we develop it into a water garden? If the old swamp be near a wood, as many of these old swamps are, the work is partly done for us, for this wood will make a delightful background, giving dainty modulations in green during the summer, and in the fall an ever-changing scheme of autumn tints. The absence of a wood need

* From a lecture delivered at the New York Botanical Garden, May 18, 1907.

not deter one, however, for much may be done in the planting of the margin of the water garden to supply this want. The question now arises, how shall we do this planting?

In the first place, what kind of water garden do we want — what kind of a water garden will lend itself to our surroundings? An old swamp or bog cannot be so developed without the expenditure of a considerable sum, for it may be necessary to build a dam to retain the waters of our spring-fed or brook-fed site, or it may require considerable digging and dredging, so the financial element must obtrude at times, and cause us to pause in our artistic impulses. If means are at hand, it is hard to imagine a more delightful occupation than turning one of these old neglected spots into a thing of beauty, and watching it develop day by day, as it more nearly approaches the ideal. Perhaps a pond is already at hand, and needs but a touch here and there to transform it. In such a case the task is much easier, and the expense involved comparatively light, for the purchase or transplanting of plants is the main item. Where an old swamp or pond is not available, an artificial pond may be made, and by properly locating this and exercising care in its planting, beautiful and natural effects may be secured. Or if only a small yard or lot is at one's disposal, let him not despair, for his love for aquatics may be indulged, to a limited extent of course, by building an aquatic tank of cement and brick; but let it appear as such, for frank artificiality is much to be preferred to poorly imitated naturalness, and in narrow quarters landscape effects are not natural. Even half barrels may be used as receptacles for aquatic plants, if these are sunk in the ground, and kept supplied with water.

Disregarding the smaller attempts at water gardening referred to above, let us consider the development of the larger efforts. In a well-arranged water garden there are two features which must be borne in mind, the fringe or margin, or what we should use as a frame for our completed picture, and the picture itself, or water garden proper. The first of these is by no means an unimportant factor, for upon the proper selection of plants to compose this frame much of the beauty of vista and harmony depends. Here we may fail at the start, especially if the site selected re-

FIG. 29. The old swamp as it was for years. The large tree on the right is a weeping willow, shown in its summer attire on the left of the following picture. The site of the dam is indicated by the old fence.

FIG. 30. The same swamp after its transformation, viewed from the opposite direction. The dam may be noticed running out from the weeping willow on the left.

quires the use of cement in forming the margins of our pond, for this well-defined artificial rim must be obliterated by the planting, if we hope for any but stiff and unnatural effects. We will assume that the drudgery of forming our pond is over, and that all is ready for the planting. Perhaps, if care has been exercised in the preliminary operations, we already have a number of shrubs on the edge of our pond; at all events, this must be our first consideration, for they are essential features in the scheme. It will not be possible here to enumerate all the plants which may be used in the making of a water garden, but some will be mentioned as suggestions for others. It is always well to bear in mind that many of the plants of the immediate neighborhood may be used to advantage for this purpose.

In the planting of the frame referred to above there is quite an array of shrubs from which to select. The smooth alder (*Alnus rugosa*) is one of these, with its mass of staminate aments borne in tassel-like profusion in March or early April, more attractive at that time from the lack of other signs of approaching summer. The American elder (*Sambucus canadensis*), more commonly known as the elder berry, deserves a place here for its profusion of flowers in early summer, followed by the large masses of purple-black fruit. Then the arrow-wood (*Viburnum dentatum*) may be used for its showy flowers; and the sweet pepper-bush (*Clethra alnifolia*) for the same reason and for the added charm of a delicious perfume. The swamp honeysuckle (*Azalea viscosa*) and the Carolina rose (*Rosa Carolina*) may both be added to our list of desirable plants, both old-time favorites of our swamps and lowlands. The Virginia winterberry or black alder (*Ilex verticillata*) should not be forgotten, its bright-red fruit being very attractive. The calico bush or mountain laurel (*Kalmia latifolia*) is too popular a favorite to need an introduction here, and its usefulness for this purpose is quite evident. The sheep laurel (*Kalmia angustifolia*), a small shrub of our swamps and low grounds, may be used where rose-colored flowers are wanted. The leather-leaf (*Chamaedaphne calyculata*), the privet andromeda (*Xolisma ligustrina*), and the stagger-bush (*Pieris Mariana*), all members of the heath family, are valuable for this purpose. The sweet bay (*Magnolia virginiana*, or *M. glauca* as it is sometimes called), itself an inhabitant of swamps, should not be forgotten in making our selection. Its flowers are of waxy whiteness and sweet-scented. The button-bush (*Cephalanthus occidentalis*), bearing its white flowers in ball-like masses, may be desired by some. The American holly (*Ilex opaca*), with its dark evergreen foliage and bright-red berries, will add much to the effect. There are, of course, many other shrubs which may be used, but from these a good selection may be made, or they may serve to suggest others.

It may be desirable to use a few trees, if the effect seems to require them. The sweet gum (*Liquidambar Styraciflua*), the leaves of which are 5–7-pointed and turn a deep crimson in autumn, is a favorite. The pepperidge or sour gum (*Nyssa sylvatica*), the swamp oak (*Quercus palustris*), and the red maple (*Acer rubrum*) suggest themselves here. The weeping willow (*Salix babylonica*) is effective where a tree with pendant branches is desirable.

Of herbaceous plants there are many which may be used in the composition of this frame. Any swamp or lowland will furnish a host of native species which will lend themselves admirably to the purpose. With our wealth of wild asters and goldenrods, sunflowers and daisies, tickseeds and coreopsis, an abundance of material is at our hand for the mere transplanting. Among others of our native plants may be mentioned our two common blue flags (*Iris versicolor* and *I. prismatica*); the pickerel weed (*Pontederia cordata*), that picturesque inhabitants of the swamps and river margins, often giving a blue tinge to the shore vegetation with its spikes of flowers; the lizard's-tail (*Saururus cernuus*), in contrast with the last with nodding spikes of white flowers; the marsh mallow (*Caltha palustris*) with its bright yellow starry flowers; the American white hellebore (*Veratrum viride*) with its stately stalks of green, adding a touch of variety; the swamp loosestrife or willow herb (*Decodon verticillatus* or *Nesaea verticillata*), a rampant grower, and especially well adapted to conceal an artificial margin; and last, but not least, the swamp rose mallow (*Hibiscus Moscheutos*), sending forth its bright pink blossoms in August, when it is exceedingly attractive.

Among the ferns which may be used are the American royal fern, the cinnamon fern, and Clayton's fern. Do not forget to add to these the stately ostrich fern. Some of our native orchids may be employed also. Among these are the yellow fringed-orchis (*Blephariglottis ciliaris*), the small purple fringed-orchis (*Blephariglottis psychodes*), the grass-pink (*Limodorum tuberosum* or *Calopogon pulchellus*), and the showy lady's-slipper (*Cypripedium reginae*). Of course there are many plants from other climes to select from. The Japanese iris (*Iris laevigata*, or *I. Kaempferi*, as it is more frequently called) is a prime favorite among these, its flowers being perhaps the largest and showiest among the irises. It may be had in a host of forms, remarkable for their beauty of coloring and shading. If a mass of purple is desired, nothing, perhaps, will give it more effectively than the spiked loosestrife (*Lythrum Salicaria*), an old-world plant, but found sometimes quite commonly as an introduction here. For a rich-red effect nothing will excel that conspicuous plant of our stream borders, the cardinal flower (*Lobelia cardinalis*). This planted in a mass with a border of green produces a most striking effect. Its near relative, with blue flowers (*Lobelia syphilitica*), the great lobelia or "blue cardinal flower," is useful where masses of blue are desired.

The aquatic garden would not be complete without the grasses. Showy and ornamental kinds suitable for this purpose are not numerous. One of the most striking, an annual, is the wild rice, or Indian rice (*Zizania aquatica*). This is a luxuriant grower and very decorative, its large panicles making their appearance in August and September, and its bright green foliage adding a touch of spring freshness to the season. Another which may be used is the common reed (*Phragmites Phragmites* or *P. communis*) of our meadows here, with grayish-green foliage. This is a taller grower than the wild rice, and its inflorescence when mature has a feathery effect, much resembling that of the old-world reed (*Arundo Donax*), a much more vigorous plant, but not as hardy here as its American relative. The Japanese reed-grass (*Miscanthus sinensis*) and its various forms have the advantage of being late bloomers, when almost all else has failed,

Fig. 11. A part of the artificial pond, showing the manner in which the rim may be concealed. In the water are some of the tender water lilies, a

and hence are a decided addition to the frame. At all times they are graceful in their foliage effect, and later with their feathery plumes are very attractive objects. Among the sedges our choice is rather limited, and we must borrow our most effective plant from northern Africa. This is the Egyptian paper plant (*Cyperus Papyrus*, or *Papyrus antiquorum*), from which the ancients made their papyrus. It is a noble plant, of a deep rich green, raising its large inflorescences six to eight feet in the air. These are unusual in appearance, and give an aspect of uniqueness to the surroundings. It is not a hardy plant, requiring the protection of a greenhouse during the winter, and this is its one drawback. It is often desirable to produce an effect of upright lines, and for this purpose nothing is better than the cat-tails, which are so abundant in some of our marshes. Either or both species may be used, the one with the narrow leaves (*Typha angustifolia*) perhaps being more graceful than the broad-leaved form (*Typha latifolia*). For a decorative plant for the shallow water near the margin of the pond, one should not forget the arrow-heads (*Sagittaria*), of which there are several species available.

With the above plants to select from and such others as individual taste may choose, a varied and effective frame may be made for our water garden. If you wish to introduce something of a tropical effect into the surroundings, use some of the aralias, already referred to, to which add a few specimens of the castor-oil plant (*Ricinus communis*), its star-shaped leaves standing out against the other foliage. If you wish to carry this tropical effect still further, introduce a plant or two of the Abyssinian banana (*Musa Ensete*), a quick grower from seed, with ample broad leaves. The thalias (*Thalia dealbata* and *T. divaricata*) are available also. It is hardly necessary to state that all these plants, with the exception of the aralias, are tender, and need the protection of a greenhouse during the winter.

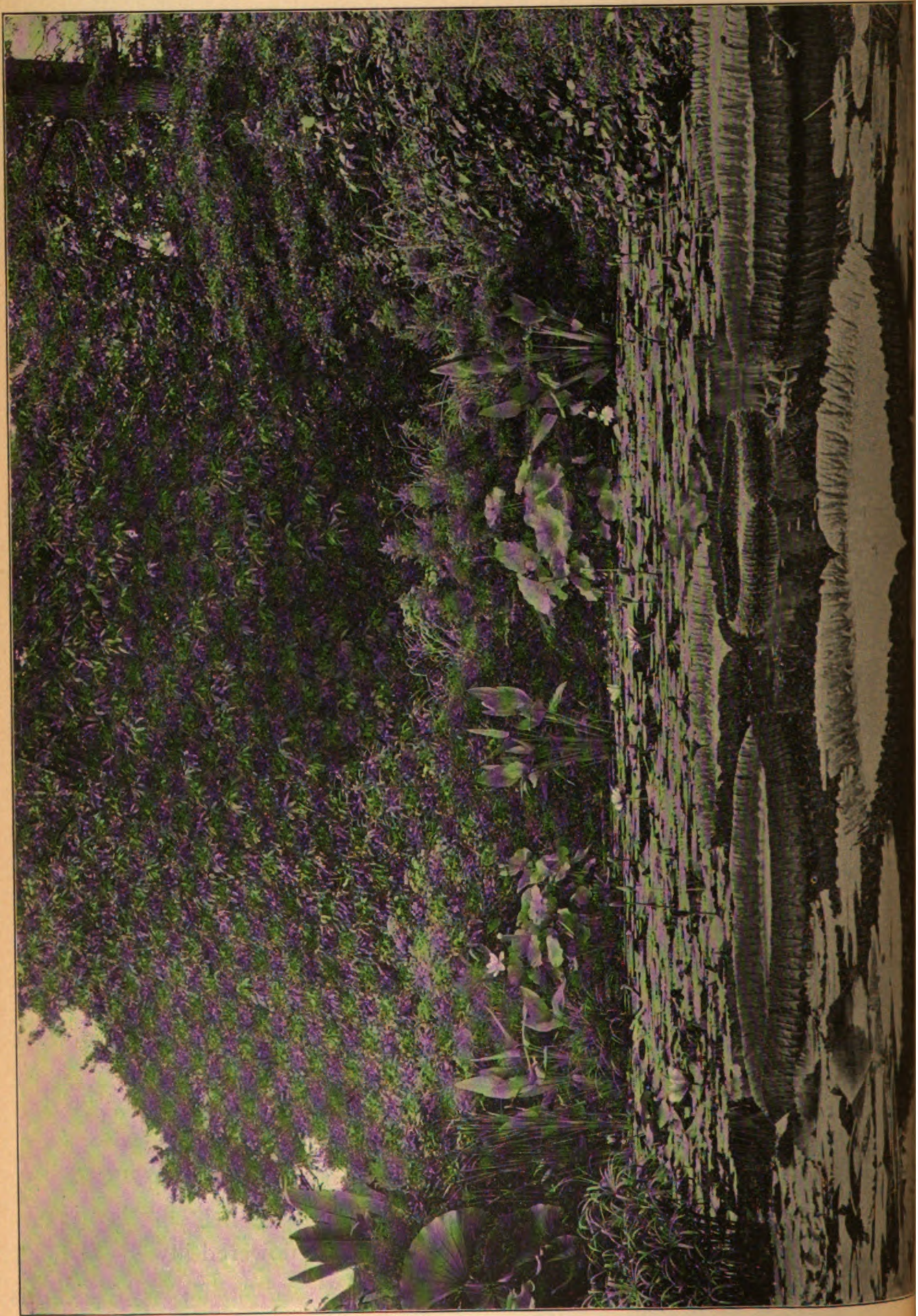
So much for the frame or fringe of our water garden. Now, what shall we use in the garden itself? Here we may explore the realms of horticultural knowledge and select some of the choicest plants. Of course the plants of first interest are the water lilies. The large royal water lilies of South America belong here also, but I will consider them later. The horticulturist's art has supplied many superb things by the careful perpetuation of occasional strains or by the creation of new ones through the medium of hybridization. I shall consider first only the hardy sorts, leaving the more tender kinds for consideration when I treat of the royal water lilies (*Victoria*), which require a similar treatment. Among the white-flowered forms, there is nothing more dainty or attractive than our own native pond lily or water lily (*Castalia odorata*), that graceful frequenter of our lakes and ponds or slowly moving streams. Its delicious fragrance and dainty form place it in the foremost rank. The tuberous water lily (*Castalia tuberosa*), also a superb white, but lacking the delicious perfume of the other, is a welcome addition. The collection is not complete without the little pygmy water lily (*Castalia tetragona*, or *C. pygmaea*), the smallest of its kind, with white flowers sometimes under two inches in diameter. In native hardy yellow lilies, we have the Florida plant (*Castalia flava*), unfortunately a shy bloomer, and less desirable for that reason; and the Mexican lily (*Castalia mexicana*), a native of Mexico and western Texas, more desirable as it is equally hardy and blooms freely. The only pink lily we have native is a form of our common pond lily, known as the pink or Cape Cod water lily (*Castalia odorata rosea*). This differs from the white form only in its pink flowers.

When we approach those produced artificially we have a larger selection. And here the productions of that wizard of hardy water lilies, M. Latour-Marliac, a Frenchman, stand without rival. He astounded the world of horticulture between 1885 and 1890 with his creations, and since then has been making almost annual additions to his achievements. He guarded so well the secrets of parentage of his hybrids that little is definitely known about them. His yellows were perhaps derived from *Castalia mexicana;* his pinks from *Castalia odorata rosea;* those with red at the center from *Castalia alba rubra*, of northern Europe; *Castalia tetragona* was certainly one of the parents of one, his dwarf yellow, *Castalia helvola;* while *Castalia odorata* must certainly enter into the problem. With these factors he has produced combinations and effects of color which have wonderfully broadened the field of use of these flowers in water gardens. All of the many beautiful things created by this genius cannot here be enumerated, but only a few of the choicest. Standing in the front rank is *Castalia Marliacea chromatella*, one of his first introductions, and perhaps the most popular of all. It is perfectly hardy, a vigorous grower, and a free bloomer; its charming yellow flowers, always a delight, resemble in form those of our own native white lily. Yellow lilies are scarce, and this is a gem among them. It was introduced about 1888 and was said by its creator to be a hybrid of *Castalia alba* and *C. mexicana*. Another desirable yellow is *Castalia helvola*, also said to have *C. mexicana* blood in it, the other parent being *Castalia tetragona*, the pygmy lily. Certainly it has the yellow color and spotted leaves of the former, and is intermediate in size between the two. It is well worth growing.

About 1889 Marliac introduced two pink forms, said to be hybrids between *Castalia alba* and *C. odorata rosea*. These are *Castalia Marliacea carnea*, and *C. Marliacea rosea*. They are very close, differing only in the deeper color of the variety *rosea*, which is the preferable form.

With *Castalia alba rubra* apparently as one of the parents, Marliac produced a number of surprising forms, all being permeated to a greater or less degree with the deep color of the parent referred to above. The most pronounced of all of these in the depth of color is *Castalia Wm. Falconer*, of a deep rich-claret, a lily which should grace all collections. Near to this in color is *Castalia James Brydon*. Those in which another element becomes prominent, introduced perhaps by *Castalia mexicana*, have the center of the flower a deep red, with the ends of the petals yellow. *Castalia Seignoreti*, *C. aurora*, and *C. gloriosa* are of this kind, and are revelations among the water lilies. There are other hybrids to be had, differing in color and markings, so that individual tastes may be consulted.

Among the white-flowered lilies, next to *Castalia odorata*, is *C. alba candidissima*, said to be a hybrid of *C. candida* and *C. alba*, of Greece. It is a vigorous grower, and must be held in check or it will run wild. Another desirable white-flowered lily



is *Castalia Gladstoniana*, with large flowers, said to be a variant from *Castalia alba*, and introduced by Mr. Richardson, of Ohio.

Belonging to the same family as the water lilies are the lotuses, that from the Old World (*Nelumbo Nelumbo*, or *N. nucifera*), and the representative from the New World (*Nelumbo lutea*). The former is frequently known as the Egyptian lotus, quite another plant, and should more properly be called the Japanese lotus. It was highly prized by the ancients, and was described by Theophrastus as growing spontaneously along the Nile, although not known to occur there at the present time. It is highly prized by both the Chinese and Japanese, and many forms, differing in color, have originated through the latter people. It is one of the most striking features of a water garden, its large peltate leaves, with the luster of satin, standing well out of the water, and swaying in every breath of air, presenting beautiful modulations of green. The large flowers ranging in different forms from the deepest pink to white, add a feature which must be wanting if this flower is left out. It is perfectly hardy and spreads rapidly; in fact it must be checked if its natural enemy the muskrat does not do this unasked, and sometimes too thoroughly. The American lotus (*Nelumbo lutea*) resembles its Japanese relative in general habit, but is far less attractive, its yellow flowers being eclipsed by its more showy rival.

All of the lilies referred to above are of the hardy sort and will withstand the rigors of our winters, of course with the natural protection of the water around them. There is another large class of water lilies which have been derived from species inhabiting tropical or warm-temperate climes. As the artificial heating of the water, especially during the early summer and spring, is of prime importance here, it is necessary to have constructed a tank or pond in which the water supply may be controlled, and the temperature raised considerably above that at which the hardy sorts will thrive. The construction of such a tank or pond is purely a mechanical process, and hardly enters into the scope of this lecture. Provided with a proper tank or pond, however, what shall we put into it in the shape of water lilies?

The tender water lilies available for this purpose are divided into two groups, one group containing those flowering in the day time, while the other comprises those in which the flowers appear at night. Taking up the day-bloomers first, one of great interest is the blue lotus of the Nile (*Castalia coerulea*), with light-blue flowers. Another and closely related species is the Cape of Good Hope lily (*Castalia capensis*, sometimes known as *C. scutifolia*), also with light-blue flowers. Still another of this day-blooming group is the Zanzibar lily (*Castalia zanzibariensis*), with fragrant flowers of the deepest blue. This is one of the best, a free bloomer and of easy culture. A marked form of this is the variety *rosea*, in which the flowers vary from carmine to pink. Among the hybrids of the day-blooming kinds *pulcherrima* and *Wm. Stone* are of great merit among the blues, while *Mrs. C. W. Ward* is a superb pink.

Among the night-blooming kinds we have the old favorite, and one of the first to attract attention, the Devonshire lily (*Castalia devoniensis*). It originated in the gardens of the Duke of Devonshire, hence its name. It is one of the best, being a free bloomer and of easy culture, with flowers of a brilliant rosy-red and sometimes a foot across. The Egyptian white lotus (*Castalia Lotus*) and the African white lotus (*Castalia Lotus dentata*) are both desirable sorts with white flowers. Another, a hybrid, is *Castalia Sturtevantii*, and very desirable. Its flowers are large and more cup-shaped than is usual in this type of lily. Others which may be used are *Castalia Omarana*, and a seedling variety derived from it, *Castalia George Huster*.

In addition to the water lilies, there are other aquatic plants which may be introduced into the collection. The blue water hyacinth (*Piaropus azurea*, commonly known as *Eichhornia azurea*) is a rampant grower, sending out its long stems in all directions. It is a free bloomer, its flowers being borne in large masses resembling in shape those of the hyacinth, hence its popular name. Another is the water hyacinth proper (*Piaropus crassipes*), of evil repute in Florida waters, with a more tufted habit and lavender flowers, and the petioles of the leaves swollen into large spongy organs which serve to keep the plant afloat. The water snowflake (*Limnanthemum indicum*), with its white star-like flowers, and the fairy water lily (*Limnanthemum trachyspermum*), also with white but smaller flowers, are useful. The water poppy (*Hydrocleys nymphoides*) is desirable for its bright-yellow flowers, and the parrot's feather (*Myriophyllum proserpinacoides*) is a charming plant, its feathery green foliage forming masses upon the surface of the water. The water lettuce (*Pistia Stratiotes*), that odd member of the same family to which our jack-in-the-pulpit belongs, forms floating masses of a peculiar light-green, and is welcome for this reason and for its oddity, All of the above are, unfortunately, tender and require the protection of a greenhouse during the winter, with the exception of the parrot's feather, which is hardy in water which does not freeze to the bottom.

If one has succeeded in growing the ordinary tender water lilies, his next ambition is to grow the queen of all aquatic plants, the royal water lily, *Victoria*. This, too, prefers the night in which to open its fragrant flowers, perfuming the air with an odor reminding one much of the pine-apple. Of this there are two species, one growing in the slow streams and lagoons from British Guiana to the Amazon region, and known as *Victoria regia;* the other a native of similar habitats in Paraguay, and called *Victoria Cruziana*, or usually by the much more recent name of *Victoria Trickeri*. The latter, being from a more southern region, and hence cooler, is much easier to grow than the former. For success with *Victoria regia* a temperature from eighty to ninety degrees must be maintained. For *Victoria Cruziana* success may be assured with a temperature considerably below this, but even then a little heat early in the summer, particularly if several days of cool weather occur, does not come amiss, and your plant will respond gratefully to this little attention. A noticeable difference in the two species is to be seen in the leaves. Those of *Victoria Cruziana* show the upturned margin, the unusual feature, almost as soon as they expand from the bud, even very young plants exhibiting this peculiarity. In *Victoria regia* the plant must have attained considerable size before this feature is in evidence, and each new leaf is slower in showing this development. For general purposes, therefore, it is better to choose, at least for the first experiment, *Victoria Cruziana*.

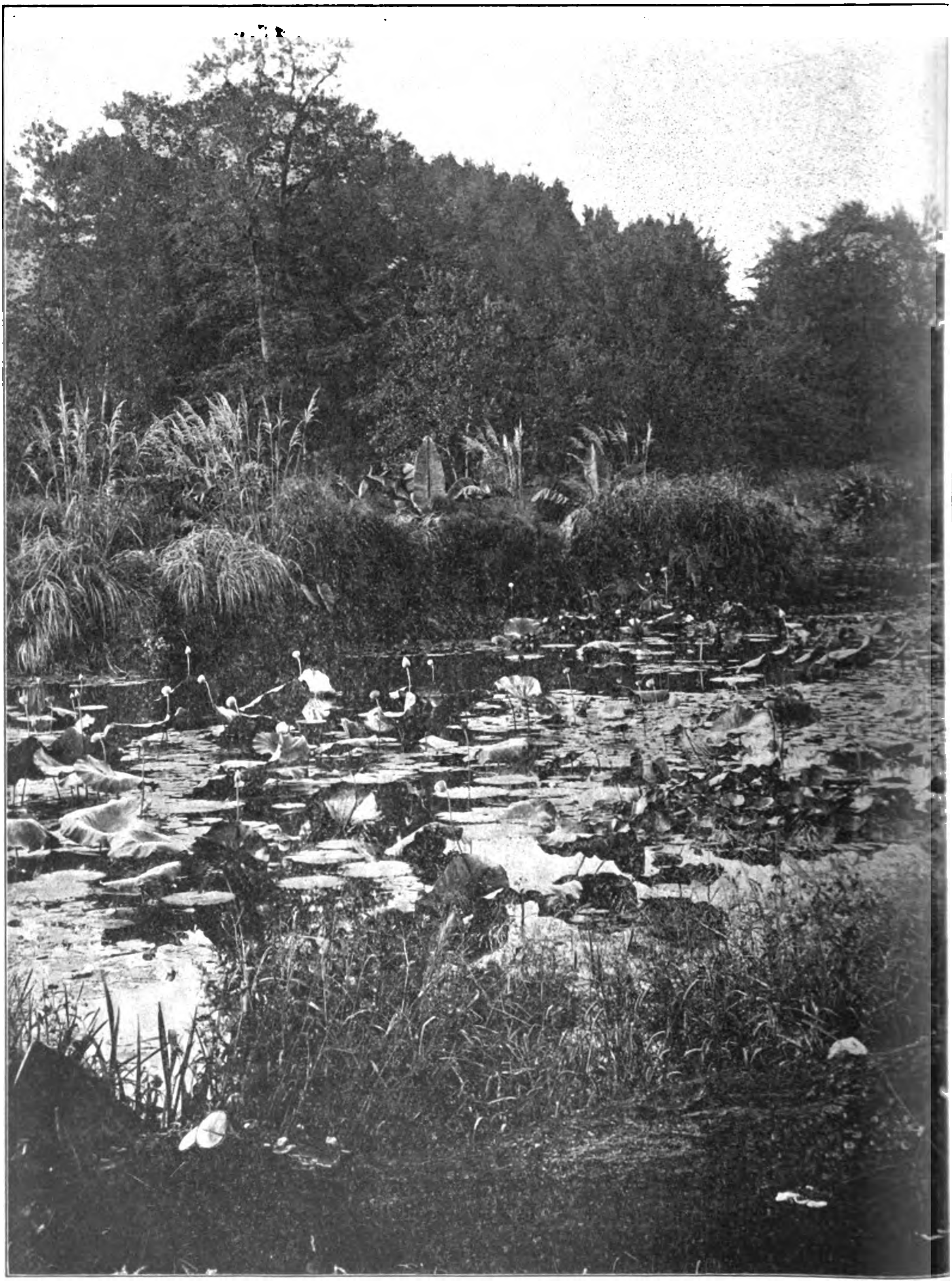


FIG. 33. A part of the natural pond, showing the background of woods, the Japanese lotus thoroughly at :a and the margin a fringe of grasses and sedges with a plant of the Abyssinian banana in the center.

A digression here from the purely horticultural side to the historical may be of interest. The *Victoria regia* was apparently first discovered about the year 1801 by that unfortunate explorer, Haenke, who was sent out by the Spanish government to investigate the vegetable productions of Peru. He found it in the marshes by the side of the Rio Marmoré, one of the tributaries of the Amazon. There seems to have been no records preserved of Haenke's impressions on beholding this wonder of the vegetable world, but perhaps they were like those of Sir Robert Schomburgh, who, on behalf of the Royal Geographical Society of London, made extensive explorations in British Guiana in the year 1837. He remarks as follows: "It was on the 1st of January, 1837, while contending with the difficulties that nature interposed, in different forms, to stem our progress up the river Berbice (lat. 4 deg. 30 min. N., long. 52 deg. W.), that we arrived at a part where the river expanded, and formed a currentless basin; some object on the southern extremity of the basin attracted my attention, and I was unable to form an idea what it could be; but animating the crew to increase the rate of their paddling, we soon came opposite the object which had raised my curiosity, and, behold, a vegetable wonder! All calamities were forgotten; I was a botanist, and felt myself rewarded! There were gigantic leaves, five to six feet across, flat, with a broad rim, lighter green above and vivid crimson below, floating upon the water; while, in character with the wonderful foliage, I saw luxuriant flowers, each consisting of numerous petals, passing in alternate tints, from pure white to rose and pink. The smooth water was covered by the blossoms, and, as I rowed from one to the other, I always found something new to admire. The flower-stalk is an inch thick near the calyx, and studded with elastic prickles about three quarters of an inch long. When expanded, the four-leaved calyx measures a foot in diameter, but is concealed by the expansion of the hundred-petalled corolla. This beautiful flower, when it first unfolds, is white, with a pink center; the color spreads as the bloom increases in age; and, at a day old, the whole is rose-coloured. As if to add to the charms of this noble Water-Lily, it diffuses a sweet scent. As in the case of others in the same tribe, the petals and stamens pass gradually into each other, and many petaloid leaves may be observed bearing vestiges of an anther. The seeds are numerous, and imbedded in a spongy substance. Ascending the river, we found this plant frequently, and the higher we advanced, the more gigantic did the specimens become; one leaf we measured was six feet five inches in diameter, the rim five inches and a half high, and the flowers a foot and a quarter across."

A lover of aquatics who has seen this queen of water lilies at its best in cultivation can appreciate the feelings of Schomburgh when he beheld this wonderful plant for the first time in all the beauty and novelty of its natural surroundings.

When the existence of this wonderful lily became known to the horticultural world, all were anxious to introduce it. The first perfect seeds which reached England were collected by Mr. Thomas Bridges, and were received at the Royal Gardens at Kew in 1846. The result from these seeds was two plants, which met an untimely end, after giving fair promise of success. Other attempts were made at introduction, both from seeds and from rootstocks, but all were unsuccessful. Finally, in 1849, seeds were secured at Kew from parties at Georgetown, Demerara. These arrived in excellent condition, and from them and several other consignments from the same parties about fifty plants were secured. One of these was sent to the famous gardens of the Duke of Devonshire, at Chatsworth. Mr. Paxton, of horticultural fame, was in charge of the gardens there, and to him belongs the honor of having flowered the *Victoria regia* in Europe for the first time, the first flower bud beginning to expand on the evening of November 8, 1849, marking the birth of this flower into the world of horticulture.

Now a word as to the enemies with which one must contend in his water garden. There is no pleasure unmixed with alloy, and the lover of aquatics cannot hope to escape this general law. He will find enemies on all sides, and these must be met and conquered. Perhaps his worst foe will be the wily muskrat. He may be caught in traps, or if too keen for this one may resort to shooting. The rootstocks of these plants seem to be very enticing to him, and this may be especially true of some choice and high-priced variety. He seems to be a connoisseur in such matters, and at times appears to select with unerring instinct the costly plants. The aphis, or green-fly, is sometimes troublesome, and is perhaps best disposed of by their natural enemy, the "lady bird." Syringing and spraying with tobacco water is also effective. Another troublesome pest is the leaf-miner, which makes unsightly furrows in the leaf surface. He can be pretty thoroughly exterminated with kerosene emulsion, applied in the same manner as with other plants. Fungous diseases, if they become troublesome, may be conquered with Bordeaux mixture.

To emphasize what I have said in the foregoing pages, permit me to call attention to the illustrations accompanying this article, which were made from photograghs taken some years ago by my father in his water garden at Clifton, New Jersey. On his place there was an old swamp full of tussocks and little pools of stagnant water, as old swamps are, and the breeding place of countless mosquitoes. The first illustration depicts this as it was. Taken in the winter time, it does not show the tangle of weeds which made this place unsightly during the summer. Through this swamp meandered a brook which had its origin in a swampy woods near by, and on either side gently sloping hillsides rose to the higher ground beyond. My father conceived the idea of developing this as a water garden, and I will let the succeeding illustrations tell the story of how well he succeeded in carrying out this conception. I will, however, add a word as to the general development of the tract. A dam was thrown across the lower end, backing the water up several feet. The tussocks were eradicated with the mattock, a laborious and costly operation, and one which experience has now shown can be done much more simply and with much less cost by merely keeping the leaves of the tussocks cut down as they appear at or near the surface, thus drowning the plants out, since such plants must have access to the air to live. The water of the pond thus formed was too cold for the more tender lilies and for the *Victoria regia.* That these might be grown, a cement pond, irregular in shape, was placed on one of the sloping sides of the swamp, sufficiently removed from the pond to permit the placing of a hot-water boiler between the two bodies of water. In the pond thus made were grown all the tender lilies and the *Victoria regia*, the latter to a perfection perhaps not surpassed elsewhere. I have spoken of the necessity of concealing the rim with plants in ponds artificially made. Let some of the photographs here reproduced illustrate how this may be done. The heating apparatus was placed in a small shed which was effectually concealed by the planting of vines, giving it the appearance of a mound near the water's edge.

This site was an ideal one for the purpose, but there are many others throughout the country equally well located. Here the two types of water garden were developed side by side: the one, the transforming of an old swamp into a beautiful lake by means of a dam; the other, the creation of a pond out of a dry hillside by purely mechanical means and artistically concealing the mechanism.

Let me emphasize not only the beauty of water gardens, but their usefulness also. Old swamps, the breeding places of mosquitoes, and hence the birthplace of much malaria, may be transformed from these pest holes into objects of beauty — may be converted from tangles of bush and briar, and scattered pools of stagnant water, into little ponds or lakes, around whose margins may be grown some of the most beautiful of flowers, and whose waters may be decked with the daintiest and most attractive members of the aquatic plant world.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT.

Dr. William L. Bray has resigned the professorship of botany in the University of Texas in order to accept the professorship of botany in Syracuse University, recently vacated by Dr. J. E. Kirkwood.

Mr. Homer D. House has resigned the associate professorship of botany and bacteriology in Clemson College, South Carolina, and will spend the coming year at the Garden.

Mr. Elmer D. Merrill, Chief Botanist of the Bureau of Science, Manila, Philippine Islands, spent some time at the Garden during September examining the Philippine collections.

Volume 25, part 1, of the North American Flora, appeared August 24, 1907. It contains descriptions of the family Geraniaceae by Miss L. T. Hanks and Dr. J. K. Small, the Oxalidaceae and Linaceae by Dr. J. K. Small, and the Erythroxylaceae by Dr. N. L. Britton.

Mr. Oakes Ames, of North Easton, Mass., well known as a student of the Orchidaceae, has presented his valuable collection of living orchids to the Garden. This collection is the result of many years work. It contains many valuable plants, some of great rarity, and is a valuable addition to the orchid collection of the Garden. A detailed account of this collection will appear in a later number of the Journal.

Some recent visitors. — Dr. J. N. Rose, of the National Herbarium, Washington, D. C.; Mr. J. L. Sheldon, of the West Virginia Agricultural Experiment Station, Morgantown, W. Va.; Dr. E. W. Brown, of Mt. Kisco, N. Y.; Mrs. Flora W. Patterson, of the Department of Agriculture, Washington, D. C.; Mr. William Dilger, Assistant Commissioner of Parks, Detroit, Mich.; Miss A. Lens, of Utrecht, Holland; and Mr. W. G. Cowell, of Auburn, N. Y.

The collection of Agaves has recently been supplemented by a large plant of the species which grows on the island of Culebra, where it was studied by Dr. Britton in the spring of 1906, at which time he enjoyed the hospitality of the Naval Station, then in charge of Commander B. T. Walling. It was not practicable at that time to get a large plant shipped to New York, but Commander Walling thoughtfully left a memorandum with his successor, Commander G. R. Salisbury, who, in July, had one of these interesting plants boxed and sent to Norfolk, Virginia, on a government vessel, from which point it was shipped by freight and received at the Garden later in the month.

Meteorology for August. — The total precipitation recorded for August was 2.59 inches. Maximum temperatures were recorded of 92° on the 8th, 89.5° on the 18th, 89° on the 21st, and 80° on the 29th; also minimum temperatures of 62° on the 10th, 52.5° on the 15th, 55° on the 23d, and 50° on the 30th.

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MUSEUMS AND HERBARIUM.

43 specimens of marine algae from Australia and South Africa. (By exchange with the British Museum.)

6 specimens of North American ferns. (Given by Dr. Philip Dowell.)

1 specimen of Scammony root for the drug collection. (Given by Dr. H. H. Rusby.)

11 specimens from Long Island, New York. (Given by Dr. R. M. Harper.)

1 specimen of *Picea Breweriana.* (By exchange with the United States Forest Service.)

406 specimens from Arizona. (By exchange with Professor J. J. Thornber.)

1 specimen of the Mexican rubber plant. (Given by Mr. H. H. York.)

80 specimens of plants from Jamaica. (By exchange with the Department of Public Gardens and Plantations, Jamaica, West Indies.)

110 specimens of tropical American plants. (By exchange with the United States National Museum.)

1 specimen of *Diaporthe parasitica* from New York. (Given by Mr. C. H. Hechler.)

1 specimen of *Diaporthe parasitica* from New York. (Given by Professor H. H. Whetzel.)

13 specimens of fleshy fungi from Indiana. (Given by Mr. Guy W. Wilson.)

350 specimens of woody fungi from New Hampshire. (Collected by Mr. Percy Wilson.)

1 specimen of fossil moss from Colorado. (Given by Professor T. D. A. Cockerell.)

2 specimens of polypores from New York. (By exchange with Professor Charles H. Peck.)

1 specimen of apple leaf-blight from West Virginia. (Given by Professor John L. Sheldon.)

1 specimen of a fungus from Washington, D. C. (Given by Professor T. D. A. Cockerell.)

1 specimen of a fungus from South Carolina. (Given by Mr. H. D. House.)

1 specimen of *Puccinia subnitens* from Kansas. (Given by Mr. Alfred C. Burrill.)

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FURTHER EXPLORATION IN JAMAICA.

To the Scientific Directors,

Gentlemen: — In accordance with your authorization to continue botanical exploration in the West Indies, I sailed for the island of Jamaica on August 24, on the Royal Mail Steam Packet "Tagus," arrived at Kingston, August 29, was in the field until September 28, leaving Kingston that day on the "Trent" of the same line, and reached New York on October 2. I was accompanied by Mrs. Britton, who aided greatly in the collection and preservation of specimens.

On arriving at Kingston I at once called on the Hon. William Fawcett, Director of Public Gardens and Plantations, at Hope Gardens, and discussed with him plans for a month's work. He most obligingly detailed Mr. William Harris, Superintendent of Public Gardens and Plantations, to accompany us, and to this kind coöperation a large part of the success of the expedition is due, Mr. Harris's intimate knowledge of Jamaica and of its flora making field operations simple and without difficulties. Mr. Fawcett also spent nearly a week with us in the field and had plants and specimens sent to Hope from the field properly cared for. A kind invitation to breakfast the following morning with His Excellency, Sir Sydney Olivier, Governor of Jamaica, at King's House, gave me a delightful opportunity to discuss with him many features of our plans for field work, and I am grateful for his advice and suggestion; it was hoped that we were to have the honor of the governor's company in the mountains during the latter part of our trip, but official duties prevented the realization of this part of the program. We also discussed the tropical research laboratory at Cinchona, held by the garden under a lease from the Jamaican government, and it is most satisfactory to know that all damages to the buildings there, caused by the earthquake of last January, have been repaired by the government.

King's House, the gubernatorial residence, was wrecked by the earthquake to such an extent as to make it uninhabitable. I had learned that Sir Sydney and Lady Olivier had expressed some desire to occupy Cinchona for a time, the delightful and salubrious climate and the surpassingly beautiful mountain scenery of that part of Jamaica making it most attractive, and inasmuch as we have no students there at present I took great pleasure in requesting them on the part of the garden to use it as a residence.

The days August 29 and 30 were thus mainly occupied, though opportunity was taken to observe many interesting plants at Hope Gardens and in the gardens at King's House, and some botanical collecting was done on the hills near Constant Spring. I also found opportunity to read the proofs of my account of "The Sedges of Jamaica," written for the Bulletin of the Department of Public Gardens and Plantations and published as a supplement to volume 5 of that journal. This document will also be issued as No. 97 of "Contributions from the New York Botanical Garden."

The first region selected for exploration was the Santa Cruz Mountains, a range of limestone situated near the southern coast in the parish of St. Elizabeth, running northwest from the coast and reaching altitudes up to 2,580 feet, and the Pedro plains, lying between the mountains and the coast. Malvern, located on top of the range, was made the base of operations. We proceeded there by way of Mandeville, located on the Manchester Mountains, taking three days travelling by railway to Williamsfield and thence by carriage; considerable collecting was accomplished about Mandeville and on the way to Malvern, which was reached on the afternoon of September 2, and where we were joined in the evening by Mr. Fawcett and Mr. Harris, who had travelled by rail to Balaclava. The climate at both Mandeville and Malvern is delightful, the roads excellent and the accommodations good ; both are favorite resorts, both by Jamaicans and by tourists. The Manchester Mountains and Santa Cruz Mountains are separated by a low wide and hot valley ; the views from the mountain sides are most attractive and interesting and many of the plants seen were new to us, the climate being much drier than that of the parts of the island visited in 1906, and the vegetation conspicuously quite different. The most conspicuous floral feature was the low tree *Bauhinia porrecta*, of the Senna Family, covered with its showy white blossoms, its new leaves just unfolding. Several orchids and bromeliads were also of special interest. The vegetation of the summit and upper slopes of the Santa Cruz Mountains was studied at points all along from Lovers' Leap, a sheer cliff of 1,600 feet on the coast, to the inland end of the range, carriages being freely used in moving from one good collecting ground to another. Several tracts of woodland, not lumbered for many years, proved most attractive and yielded us specimens of many rare trees and shrubs. The special object of search on these mountains was the small tree *Peltostigma pteleoides* of the Rue Family. This apparently extremely local species was obtained here in 1843 or 1844 by William Purdie, a collector sent to Jamaica from the Royal Gardens at Kew, England, and not since seen in Jamaica by botanists ; specimens of it are extremely rare, and were much needed in connection with the studies of Rutaceae by Mr. Percy Wilson for publication in the "North America Flora." We sought this tree for six days, examining a large area of the mountains, and were finally rewarded by finding it in considerable quantity on the southern side of a single wooded hill at Potsdam, nearly or quite at the summit of the mountain range. Our delight can be imagined, and the luck was quite equally divided, because while Mr. Harris was gloating over the prize near one end of the hill and endeavoring to make me hear him rejoice, I was experiencing quite the same enjoyment at the other, the two colonies being perhaps half a mile apart, though we subsequently found that they were irregularly connected. The tree was in young fruit and bore some of the old fruits of last year, but no flowers could be had, and a visit to the locality at another time of year, presumably in July, will be necessary to obtain them. We prepared a large number of herbarium specimens, cut down a tree for wood specimens, and pulled up seedlings, which were abundant, for growing at Hope Gardens and at the Bronx. Our thanks are gratefully tendered to A. E. Harrison, B. A., Head Master of the Potsdam School, and Mrs. Harrison for their aid and hospitality while exploring this woodland, which is fortunately the property of this well-known school, ensuring the preservation of the *Peltostigma;* also to Miss C. Gertrude Pearman who aided in the collecting of specimens there.

Lovers' Leap, already mentioned as a precipice at the coastal end of the Santa Cruz Mountains, is on the Yardley Chase estate, the property of Mr. W. Panton Forbes. The rock cliffs support a variety of interesting plants and we made a large collection there and in the vicinity. One of my principal objects in exploring the dry south side of Jamaica was to study the native cactuses and obtain additional specimens of them, and here we found one of the large species, the Jamaican *Pilocereus*, a branched columnar plant 15 feet high, in quite an unexpected position on the cliffs at 1,600 feet altitude. We had not previously observed it growing at more than 200 or 300 feet altitude above the sea, and I think this must be the greatest elevation known for any plants of this genus in the West Indies. Pedro Bay, situated across the Pedro Plains south of the Santa Cruz mountains, was described to us as a cactus region and three days were devoted to collecting there and in the vicinity; this work was made convenient and comfortable by the kindness of Mr. W. Panton Forbes who gave us the use of his cottage on the shore. This is a region of very low rainfall, and the cacti thrive exceedingly, forming extensive groves, though we found no different species from those growing along the coast near Kingston, though many other plants were of much interest, notably the rare wand-like shrub *Lasiocroton macrophyllus* of the Spurge Family, which grew in honeycombed limestone. We thought that we might find here the little yellow-flowered cactus *Mamillaria simplex*, of special nterest as the type of its genus, and which Grisebach credits to Jamaica in his "Flora of the British West Indies" as found by Dr. Patrick Browne about the middle of the eighteenth century and not since seen in Jamaica, but we were unsuccessful. Search and inquiry were also made here and later further west along the coast for two other rare or perhaps dubious plants of Jamaica, one a Cycad, *Zamia integrifolia*, accredited to Jamaica by Grisebach "in arid places along the coast," on the evidence of a specimen in the museum at Kew, the other a low palm with prickly leaf-stalks, *Copernicia tectorum*, the occurrence of which in Jamaica is also indefinite.

The work on the Santa Cruz Mountains was brought to a close on September 11 by a visit to the forests on the Stanmore Hill estate, toward the northwestern end of the range, from which we had been driven out by rain on a previous visit a few days before. Permission to explore these interesting woods had kindly been given by the proprietors, the Hon. John V. Calder and Mrs. Calder, who have carefully preserved them in a natural state; they contain many rare or unusual trees, some of which were in bloom at the time, and some are probably new to science. One of the most interesting is the tall Smooth Mountain Pride, *Spathelia glabrescens*, with its columnar unbranched trunk over sixty feet high, crowned by a tuft of pinnately compound leaves, of which we secured the fruit, hitherto unknown. These Stanmore Hill woods will well repay further exploration, inasmuch as we observed a number of trees in leaf only which neither Mr. Harris nor I could recognize.

Our second base was made at Newmarket, a small market town at an elevation of about 1,150 feet, located near the boundary of the parishes of Saint Elizabeth and Westmoreland, conveniently situated for the exploration of the morass and coastal regions of western Saint Elizabeth and eastern Westmoreland and the hills adjacent. We travelled to Newmarket from Malvern by way of Black River, a seaport town where parts of two days were given to a study of the coastal flora. Our thanks are gratefully tendered to Dr. A. R. Todd for information, and for guidance to Longacre Point west of Black River, and vicinity, where considerable collections were made, perhaps the most interesting plant being a tall palm of the sand dunes, a species of *Thrinax*, known there as Bay Thatch and Pimento Thatch, with bright green, stiff leaves, apparently quite different from the *Thrinax excelsa* of the hills and mountains; good fruiting specimens and a number of seedlings were secured. A morass on the property of Dr. Todd yielded many interesting marsh plants, and in a ravine along the road on the way to Newmarket we collected some hillside species not elsewhere observed.

Newmarket was made a base of operations from September 13 to September 21. Collections were made in the immediate vicinity and in the hills of eastern Westmoreland especially about Darliston and Beaufort where we found a very interesting flora. This region is much wetter than the Santa Cruz Mountains, and showers were experienced nearly every afternoon. A fine bromeliad of the genus *Hohenbergia* was abundant on trees and good living specimens of it were obtained; it is either a rare or undescribed species and is an important addition to our collection of these interesting air-plants; several fine orchids were also secured and a large flat-stemmed drooping cactus of the genus *Rhipsalis* growing on rocks and trees was a prize which pleased us greatly. Several species of trees were new to us, and the cabbage palm and long-thatch palm grow there in great perfection and large size. We are indebted to Mr. H. W. Farquharson for permission to explore the woodlands on his Hopeton estate near Darliston, where a rare leafless ground orchid, perhaps new to science was obtained.

From Newmarket two trips were made by carriage to the lowlands. One of these was to the valley of the Black River at Lacovia, where we secured the services of a negro with a dug-out canoe and explored the river-banks for about two miles above the town. The stream is arched over by many kinds of tropical trees with vines hanging from them, and the experience was a delightful one, although obtaining specimens from the canoe was not without difficulty. Another of the long-sought Jamaican trees was found here in considerable abundance; this is the leguminous species described by Grisebach under the name *Crudya spicata*, previously recorded as growing in the great morass of Westmoreland; it has pinnate leaves and large, flat roundish pods. A fine white-flowered *Crinum* grows in the muddy banks and specimens for cultivation were obtained. On the same day we visited Mr. M. H. M. Farquharson's estate, Cornwall, near Lacovia, in order to see the pond where the Yellow Lotus of Jamaica (*Nelumbo*) was known to grow; we were received with great cordiality, and Mr. Farquharson personally conducted us to this interesting pond and marsh. The *Nelumbo* was both in bloom and in fruit; specimens were carefully prepared for comparison with the similar plant of the United States, and seeds, kept in water to make their germination likely, were taken for planting at Hope Gardens and at the Bronx. A number of other interesting marsh and pond-shore plants were collected here.

The other low-land expedition was to the Font Hill estate, near Luana Point, a few miles west of Black River. Dr. Todd had kindly arranged with Mr. Charles E. Isaacs, in charge of this estate in the absence of the owner, the Rev. Samuel Spencer-Smith, that we might breakfast with him, and we were given delightful hospitality. Our collecting here was mostly on the coastal sands and rocks and we had an excellent opportunity to study the littoral flora.

We left the Newmarket base on the morning of September 22, and drove to Bluefields, passing through the beautiful ravine known as Tea Gully, which abounds in ferns and mosses, and from Bluefields to Black River, collecting some specimens along the way. The next day we drove from Black River to Lacovia, passing along the western side of the large morass at Middle Quarters. An elegant tall palm, resembling the cabbage and royal palms, had been observed by us in this morass on our previous trip to Lacovia, but access to it at that time seemed impossible. On this occasion, however, a tree was seen in flower and fruit at no great distance from the road, and after securing the guidance of a negro who could climb trees, I finally made my way to it through the swamp and was ultimately rewarded by securing good specimens, including seeds for planting, together with material of other marsh plants not previously seen by us.

Arriving at Lacovia, we sent the carriage along some five miles to Santa Cruz, and made a further study of the banks of the Black River, this time in a rowboat belonging to Mr. Farquharson, and ascended the stream for about seven miles to Elham wharf, where we arrived at dark; our special search was for the vine *Combretum Jacquini*, another rare Jamaican plant, the peculiar four-winged fruits of which we had found floating on the water during our previous canoe-trip; we finally encountered the vine just about dusk, a short distance below Elham wharf, but could obtain only its foliage, its flowering time being evidently earlier in the year. We reached Santa Cruz during the evening.

Return from those interesting regions was made by way of Mandeville, where we arrived on September 24, reaching Kingston the next day. September 26 and 27 were passed at Hope Gardens in the delightful hospitality of Mr. Fawcett. The last collecting done was in the valley of the Hope River, below August Town, where Mr. Fawcett, Mr. Harris, and I spent the afternoon of September 27. Here we were also much interested in observing the land-slides caused by the earthquake of last anuary, on the sides of Long Mountain and Mona Mountain, where the Hope River runs through a narrow gorge, and where the fallen debris of rock and earth has dammed the stream, forming a long narrow lake.

The expedition has added much to the knowledge of the Jamaican flora and the plants and specimens secured are important additions to our collections. Nearly 1,000 field numbers represent some 2,000 specimens for the museums, herbarium and greenhouses, and, in addition to these, are the collections made by Mr. Harris, of which we will receive the duplicates. The work was made possible by the kind liberality of Mr. D. O. Mills, President of the Garden.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

THE ABSENCE OF UNDERGROWTH IN THE HEMLOCK FOREST.

The contrast in the character of the forest floor in evergreen and in deciduous forests is a familiar fact. In a forest where narrow-leaved, evergreen conifers predominate the floor is almost wholly devoid of the shrubs and herbs of low habit, which form so conspicuous a feature of the floor in a forest of broad-leaved, deciduous trees. In walking through a hemlock forest for example, one passes unhampered over a carpet formed of the dry, brown, fallen leaves. This leaf-cover is broken only at irregular and rare intervals, and usually where the sun has easy access, by small groups or isolated individuals of herbaceous plants. But, walking through a deciduous forest, one can often scarcely take a step without treading on the green herbs.

In the photograph (Fig. 34) this contrast is shown in a striking manner. The picture was taken from a path that passes through the forest near the recently constructed rubble bridge. The area to the left marks the edge of the hemlocks, that to the right the beginning of the deciduous trees. Under the conifers there is a practically entire absence of shrubs and herbs, while under the broad-leaved trees they grow abundant and varied. *Falcata comosa*, *Parthenocissus quinquefolia*, *Rhus toxicodendron*, *Aster*, *Solidago*, *Ambrosia trifida*, *and Deringa canadensis* predominate. The boundary between the two types of floor is clean-cut and conspicuous, and the invitation it presents to strollers through the woods has been generously accepted. This is attested by the well-worn path along the edge of the undergrowth, and the path serves to further emphasize the contrast. Scarcely an herb is found in the area under the hemlocks. The illumination of the two areas, especially where they adjoin, is, to all appearances, practically the same.

This difference in the undergrowth of the two kinds of forest is probably due to a combination of causes. Difference in illumination may be a factor, but this alone cannot account for the difference, for the seedlings of the hemlock, which is a tolerant, or shade-bearing species, do not normally come to maturity

Fig. 34. Portion of the boundary line between the hemlock and the deciduous forest areas, New York Botanical Garden.

under the shade of the parent tree, nor of neighboring trees of that species. This fact suggests that conditions in the soil are also a factor. The suggestion is rendered all the more probable by the fact that hemlocks are frequently not among the plants growing in the open areas, and especially by the fact that hemlock seedlings readily develop under the white pine (*Pinus strobus*), so that the latter species is sometimes replaced by hemlock.*

The fact that white pine seedlings will not develop under hemlock may be explained, in part at least, by the fact that the white pine is an intolerant, or light-demanding, species. It fails to develop under the shade of oaks, chestnuts, etc., as well as under hemlocks, while hemlock develops easily under the shade of those species.

It has been asserted † that the seeds of hemlock "cannot germinate under the trees that bear them." This certainly is an erroneous notion as can be demonstrated by careful observation. In the hemlock forest in the New York Botanical Garden young seedlings may be observed in the spring in abundance under the trees, even to within less than a foot of the trunk. In no case however, has the writer ever found these seedlings attaining a height of more than eight or ten centimeters (three or four inches). Some cause interferes with their further development. Since the species is a tolerant, or shade-loving one, and since the seedlings may develop into vigorous saplings in the shade of a broad-leaved, deciduous forest, the conclusion seems warranted that their failure to develop near the parent trees is due partly to conditions in the soil.

It is a well-known fact that many plants, grown in a substratum of soil or other nutrient medium, excrete into the substratum substances that are deleterious to that species, so that it is difficult or even impossible, to grow a second or third crop of the same species in the same soil. Thus Livingston ‡ found that wheat seedlings grown in clean glass sand in which wheat had previously

* Pinchot, Gifford. A primer of forestry. Part I., p. 33. Washington. 1903.

† The Hemlock Grove on the Banks of Bronx River. Trans. Bronx Acad. Arts & Sci. 1, Pt. I.: 6. 1906. Also, Cont. N. Y. Bot. Garden, No. 83, p. 6. 1906.

‡ Livingston, Burton Edward, Bull. 28, Bur. of Soils, U. S. Dept. Agric. 1905.

grown for twenty-one days, attained a growth less than one half that attained by wheat seedlings similarly grown in clean glass sand not previously thus used. More recently Shreiner and Reed * have shown that "healthy growing plants excrete from their roots substances which have a deleterious effect upon the growth of the root."

It seems not improbable that in these facts may lie a partial explanation of the failure of hemlock seedlings to reach any considerable development under trees of the same species.

C. STUART GAGER.

A RARE SEEDLING AT THE PROPAGATING HOUSES.

Through the kindness of the Director of the Royal Gardens, Kew, we have been so fortunate as to secure several seeds of the wonderful "Tumbo," or *Welwitschia mirabilis.** The seeds were planted early in April, and at present there are two healthy seedlings, that give every indication of becoming strong and robust examples of their kind.

The upper half of the accompanying photograph (Fig. 35) shows the first two seed-leaves, or cotyledons, as they are called. These are narrow spatulate leaves about one and one half inches long

* Shreiner and Reed, Bull. Torrey Club 34 : 279. 1907.

† Owing to an unfortunate error the above name cannot be used for this plant. In a letter to the Linnaean Society, Dr. Welwitsch, its discoverer, suggested that it be called *Tumboa*, from its vernacular name of "Tumbo." To this Sir Joseph Hooker demurred. He asked, and received, permission from Welwitsch to name it *Welwitschia mirabilis*, in honor of its collector.

Shortly afterward a Mr. T. Baines sent in some plants that were erroneously supposed to be different from the plant of Welwitsch, and temporarily received the name of *Tumboa Bainesii*, during the discussions of the society. The results of this controversy were published in the regular minutes of the society, appearing in the Gardeners Chronicle, together with a note to the effect that the plant was subsequently to be described by Hooker in the Transactions of the Linnaean Society. Two years later a comprehensive monograph was published, in which the Welwitsch and Baines plants were proved to be identical. The name, as previously decided upon, was *Welwitschia mirabilis*, but, according to the rules of nomenclature now in use, a name once allowed to slip into print is considered a definite publication, whether it was the intention to really name and describe the plant or not.

We must in the future, therefore, refer to this remarkable plant as *Tumboa Bainesii*.

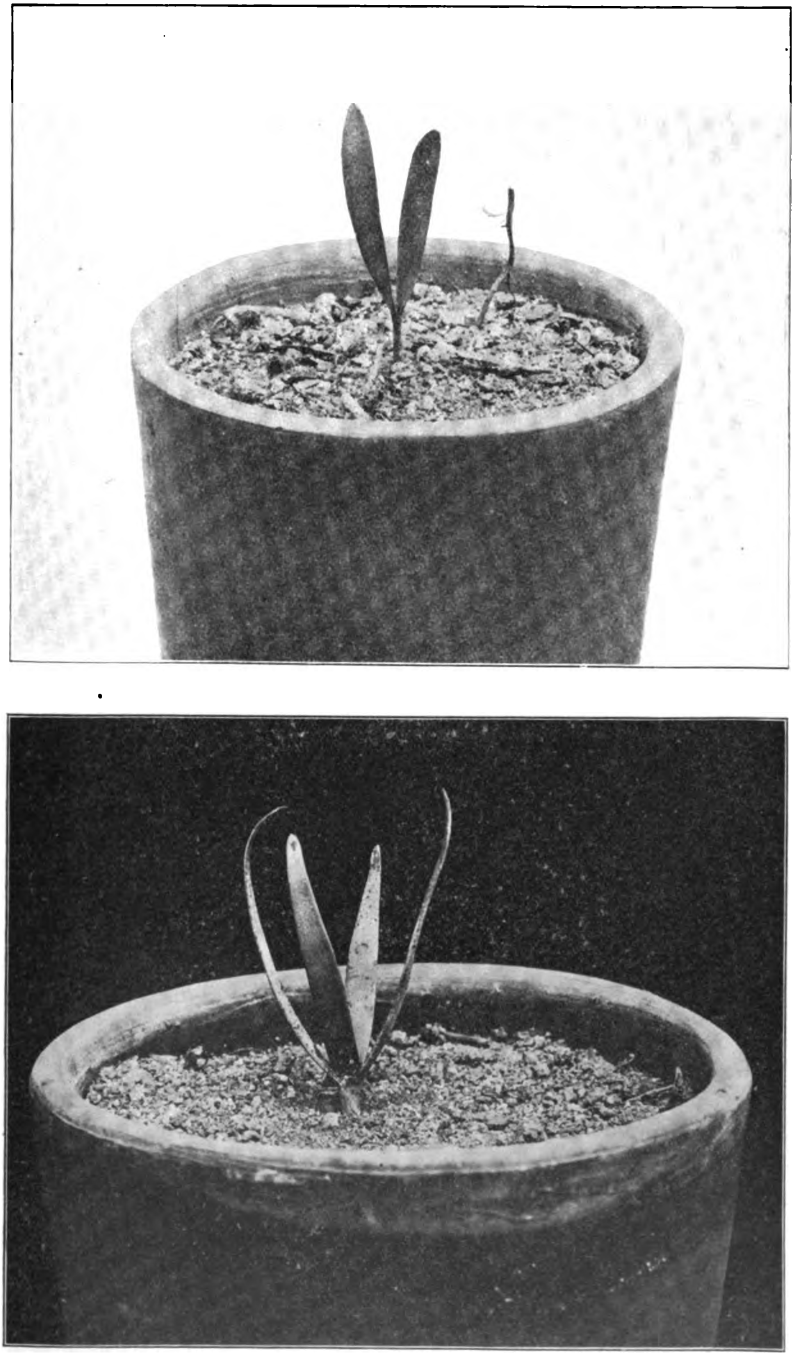

FIG. 35. Seedling of *Tumboa Bainesii.*

and three eighths of an inch broad. In the original description of the plant it is stated, on the authority of Welwitsch, its discoverer, that these are the only leaves that are ever produced during the conjectural one hundred years of the plant's life. This was a somewhat gratuitous assumption, as neither Dr. Welwitsch nor Sir Joseph Hooker had ever seen a seedling.

What really happens is that after the seed-leaves are about a month old, a second pair of leaves springs out from between the first, and opposite them. These later ones develop into the only adult leaves that the plant ever produces. The lower figure shows the two pairs of leaves when the plant is about six months old.

One is apt to question, in view of these pictures and the description, why the plant should ever have been called remarkable; for at this stage it seems to be a very ordinary little seedling. Little does one suspect that this inconspicuous plantlet will develop into a gigantic vegetable monstrosity, weird in its unique ugliness, and well deserving the discussion and amazement that its discovery occasioned.

The mature "Tumbo" * is a "tree" with a "trunk" about two feet long shaped much like an inverted cone. Almost all the "trunk" is below the surface of the ground, the visible part rarely exceeding a few inches. But the remarkable feature of the stem is that it is often fourteen feet in circumference, and becomes more or less two-lobed in age. The stem looks more like a great mass of "the burnt crust of a loaf of bread," to quote Dr. Welwitsch's letter, than the trunk of a tree. The underground portion becomes greatly elongated and its continuation is the tap-root of the plant. This goes down several feet, in its effort to get the few drops of water that the arid conditions of the country permit.

There are never more than two leaves after the seed-leaves drop off, and very curious leaves they are. Starting from a groove on opposite sides of the depressed mass, they stand straight

* "Tumbo" is also a name used for a number of other plants in Portugese West Africa. There are also several other names applied to our plant, notably "Ghories" (Hottentot) and "Nyanka-Hykampop" (Damara).

out on both sides of the plant. They are often six feet long and two feet wide and usually split into ribbons that undulate over the ground in a way strikingly suggestive of the tentacles of an octopus. With its great ugly body and its tentacle-like leaves, it is no wonder that it should have been the most remarkable plant novelty of the last century. The flowers are borne in scarlet cones on a cymose inflorescence coming from the crown of the "trunk." *

Tumboa Bainesii belongs to the Joint-fir family, or Gnetaceae, and is known only from Portugese West Africa and Damara Land. This is a region that seldom gets any rain, and desert conditions prevail almost completely, except for the sea fogs. The "Tumbo" is thus a desert plant *par excellence* and it is only by a close approximation of these very arid conditions that we can hope to cultivate it. It is exceedingly rare in cultivation and there seem to be scarcely any recorded cases of its successful germination under glass, nearly all the previously cultivated specimens having been brought directly from Africa.

NORMAN TAYLOR.

NOTES, NEWS AND COMMENT.

Dr. C. B. Robinson, assistant curator, spent two or three weeks of his summer vacation in making collections at the Bay of Seven Islands, Saguenay, Quebec.

Mr. Allen H. Curtiss, well known as a collector and student of the plants of the southern United States and of the West Indies, died in Jacksonville, Florida, on September 1, in the sixty-third year of his age.

Mr. W. D. Hoyt, of Baltimore, Maryland, spent some time at the Garden during September and October examining the collections of marine algae.

Dr. Heinrich Hasselbring, assistant in botany in the University of Chicago, has been appointed assistant botanist at the Cuban Agricultural Experiment Station, at Santiago de las Vegas.

* There are good illustrations of *Tumboa Bainesii* in the Botanical Magazine and in the Transactions of the Linnaean Society of London for the year 1863.

An international conference on plant hardiness and acclimatization was held in this city October 1, 2 and 3, under the auspices of the Horticultural Society of New York. On October 3 the members of the conference were guests of the garden; the forenoon being devoted to the reading of papers and the afternoon to the inspection of the collections. Luncheon was served in the laboratories.

A very interesting fungus was recently presented to the garden by the China and Japan Trading Company, of this city. A bale of cotton cloth, made in this country, stored for a year in Shanghai, China, and lately returned to New York by a Suez steamer, was wet in the voyage home, and, standing in the warehouse of the company here, developed the fungus. The fruit-body is about ten inches broad, six inches long, and four inches high. It consists of a mass of pure white, overlapping, leaf-like portions arising from a common point of attachment on the outside of the bale and connected with the vegetative portion of the fungus (mycelium), which permeates the inside of the bale in the form of numerous minute white threads. The plant is readily recognized as belonging to the genus *Pleurotus*, of the fleshy fungi, but the species has not yet been determined.

Some Recent Visitors. — Professor C. F. Austin, of the Cuban Agricultural Experiment Station; Mr. P. L. Ricker, of the National Herbarium, Washington, D. C.; Mr. Charles E. Monroe, of Milwaukee, Wis.; Major E. W. Woodward, of Oakland, Cal.; Mr. H. C. Irish, of the Missouri Botanical Garden, St. Louis; Professor N. E. Hansen, of Brookings, S. D.; Mr. E. M. East, of New Haven, Conn.; Mr. W. H. Evans, of Washington, D. C.; Professor W. A. Munson, of Morgantown, W. Va.; Professor H. L. Hutt, of Guelph, Canada, and W. T. Macoun, of Ottawa, Canada.

Meteorology for September. — The total precipitation for the month was 7.93 inches. Maximum temperatures were recorded of 80° on the 1st, 81° on the 7th, 85° on the 15th, 89° on the 21st, and 79° on the 23d; also minimum temperatures of 59° on the 7th, 55° on the 13th, 53° on the 19th, and 34° on the 27th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

58 specimens of mosses from Salisbury, Connecticut. (By exchange with Mr. Geo. E. Nichols.)

77 specimens of ferns and flowering plants from tropical America. (By exchange with the U. S. National Museum.)

1 specimen of *Gentiana Douglasiana* from British Columbia. (Given by Professor James Fletcher.)

2 specimens of *Androsace* from New Mexico. (Given by Professor E. O. Wooton.)

17 mosses from Hayti. (By exchange with Mr. F. Renauld.)

9 specimens of flowering plants and ferns from New Jersey. (Given by Mr. Macy Carhart.)

3 specimens of flowering plants from Canada. (Given by Mr. J. M. Macoun.)

19 specimens from Colorado. (Given by Mr. H. L. Shantz.)

1 specimen of *Rosa Maximiliani* from Colorado. (Given by Professor T. D. A. Cockerell.)

2 specimens of mosses from Madagascar. (By exchange with Mr. F. Renauld.)

4 specimens of *Solidago* from Staten Island. (Given by Dr. A. Hollick.)

1 specimen of *Quercus* from Connecticut. (Given by Professor L. M. Underwood.)

2 specimens of fungi from Bronx Park. (Collected by Mr. R. C. Benedict.)

5 specimens of fungi from Redding, Conn. (Given by Professor L. M. Underwood.)

10 specimens of fungi from Connecticut. (Collected by Mr. R. C. Benedict.)

5 fungi from the Conservatories of the New York Botanical Garden. (Collected by Dr. W. A. Murrill.)

12 specimens of fungi from Ithaca, New York. (Given by Mr. C. J. Humphrey.)

1 fungus from Maine. (Given by Mr. C. C. Hanmer.)

1 fungus from China. (Given by the China and Japan Trading Company.)

1 specimen of *Porodiscus pendulus* from Guatemala. (Given by Prof. W. A. Kellerman.)

50 specimens of fungi from North Carolina. (Given by Miss Gertrude S. Burlingham.)

PLANTS AND SEEDS.

1,530 orchids for conservatories. (Given by Mr. Oakes Ames.)

6 plants for conservatories. (Given by Mrs. H. L. Britton.)

14 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 plant for conservatories. (Given by Commander Salisbury.)

5 plants for conservatories. (By exchange with La Mortola Gardens, Italy.)

10 plants for herbaceous grounds. (Collected by Mrs. E. G. Britton.)

10 plants for conservatories. (Given by Mr. Pratt.)

8 plants for conservatories. (Given by Miss Helen M. Gould.)

5 plants for conservatories. (By exchange with Bureau of Plant Industry, U. S. Department of Agriculture.)

9 plants for conservatories. (Given by Mr. E. F. Cabada.)
13 plants for conservatories. (Given by Mr. F. F. von Wilmowsky.)
3 plants for conservatories. (Given by Dr. Hochreutiner, Geneva, Switzerland.)
1 plant for conservatories. (Given by Mr. A. Müller.)
67 plants for nursery. (Collected by Mr. R. C. Benedict.)
1 plant for nursery. (Given by Mrs. J. E. Messenger.)
1 plant for conservatories. (Collected by Mr. W. E. Broadway, Trinidad.)
6 plants for conservatories. (Given by Mr. Gilbert A. Albury.)
1 plant for conservatories. (Given by Mrs. Beckwith.)
6 plants for conservatories. (Given by Mr. G. E. Barre.)
1 packet of seed. (Given by Dr. Hochreutiner, Geneva, Switzerland.)
4 packets of seed. (Given by Mr. F. F. von Wilmowsky.)
2 packets of seed. (Given by Dr. H. H. Rusby.)
2 packets of seed. (By exchange with Dr. C. F. Baker, Cuba.)
316 plants derived from seed from various sources.

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THE BOULDER BRIDGE.

The bridge built during the last year on the site of the old wooden structure across the Bronx River at the northern end of the hemlock grove, was completed in September, under the contract awarded by the Commissioners of Parks on October 18, 1906, to M. J. Leahy. It consists entirely of boulders, selected from old stone walls, and unearthed during grading operations; very nearly all these stones are trap-rock (diabase), brought by the glaciers of the ice-period from the Palisades of the Hudson, which lie directly in the line of the glacial movement, as evidenced by grooves cut in the ledges of gneiss and schist, so abundantly exposed in parts of the Garden grounds and beautifully illustrated on the ledges along the western side of the valley of the herbaceous garden, where a path has been laid so as to cross one of these exposures. At this point the direction of the glacial groovings is seen to be a few degrees to the east of south, and this line continued northward would strike the Palisades about opposite Yonkers. These trap-rock boulders are the most abundant large stones in the glacial drift of Bronx Park and the surrounding country, and in places they are exceedingly numerous, so abundant in fact as to make grading operations difficult and expensive. During our first grading work we hauled a great many of these boulders into low grounds which had to be filled, but it occurred to us several years ago that a bridge might be built of them, and Mr. John R. Brinley, landscape engineer of the Garden, made a study for such a structure, which was subsequently approved by the Board of Managers, by the Commissioner of Parks, and by the Art Commission. After this had been determined, the boulders were saved rather than buried, and the result is now to be seen, complete, in so far as the stone work is concerned. The bridge is unique, we believe, for this part of the country, and it fits into its natural surroundings as well, or perhaps better, than any other type of structure would have done. The total length of the bridge is 172 feet, the width of the pathway across it 15 feet, and the three central arches and the two arches at the ends of the bridge are 16 feet wide. In order to insure sufficient area in the cross-section of the valley for freshets, the bridge has been built eight feet higher in the center than the wooden structure which it has replaced, and, as a further precaution, the path approach from the east will be built at a low elevation in order to permit flood water to pass over it, which is not apt to happen more than once in several years, and it may be that the arches will take it all even at the periods of greatest flood.

The bridge foundations rest, like those of the three driveway bridges, on a stratum of gravel and coarse sand which underlies the whole northern end of the Garden from the lakes to Williamsbridge at just about the same level, being some six feet below the surface of the river at average flow. The presence of this excellent material on which to build these heavy structures is very fortunate, and no better basis could be desired; a careful inspection of the three driveway bridges shows no trace of settling in any of them.

The method adopted by Mr. Leahy for building the arches in such a way as to get a boulder finish on the under-side was ingenious. The wooden centers were first erected and the boulders were placed in a layer of sand about six inches thick and thoroughly groutted together with strong cement; after this had set, and the centers were taken away, the sand fell to the ground, leaving from four to six inches of the underside of the stones exposed, when a small amount of trimming of the rough cement edges gave the desired finish. The beauty of this, and indeed of the entire structure, is largely due to the care and ingenuity of Mr. John Baxendale, the foreman of the work; scarcely any of the boulders have been nicked or otherwise damaged, and Mr. Brinley's design has been carried out most accurately.

A temporary earth and ash path has been laid across the bridge so that it can be used, and a permanent surface, with path approaches, may be built next spring after the filling needed at the east end and between the arches has settled down. Mr. Brinley's landscape design for the surroundings of the bridge calls for an excavation under the eastern of the three larger

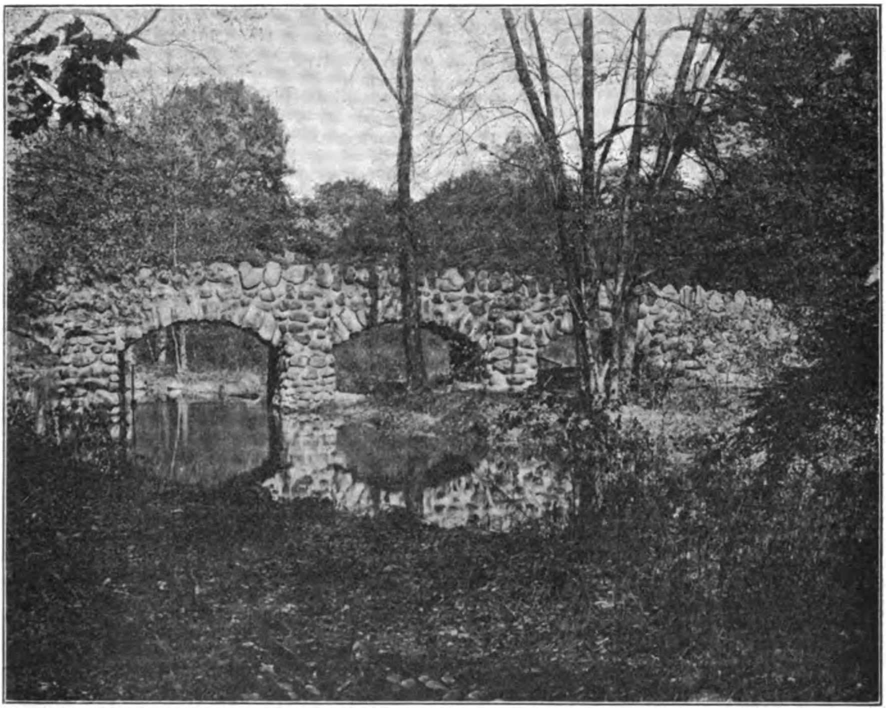

FIG. 36. The Boulder Bridge.

arches so as to permit the river to flow through all three of them, and the continuation of this excavation southward through a swale leaving a narrow island, about two hundred feet long, south of the bridge: the plan also contemplates the excavation of the marshy ground north of the bridge on the east side of the river for the establishment of a small lake to be used for water-lilies and other aquatic plants, the cultivation of which at this point, however, can only be satisfactorily accomplished when the river valley is freed of muskrats, on which a more or less continuous war has been waged for several years and large numbers of the animals taken by traps, but, while less numerous than a few years ago, they are still very troublesome, and find in the rootstocks of *Castalia* one of their favorite foods.

The contract price for the bridge was eleven thousand dollars; the cost of path approaches, excavation for the river, and for the pond, will probably amount to fifteen hundred or two thousand dollars.

N. L. BRITTON.

THE AMES COLLECTION OF ORCHIDS.

In the September number of this Journal reference was made to this valuable collection of orchids, recently acquired. The collection has now been temporarily arranged so that it has been possible to study and briefly describe it.

Early in September Mr. Oakes Ames offered this collection to the Garden, and the writer immediately went to North Easton, Mass., to superintend its proper packing and transportation. This work was greatly facilitated by the assistance of Mr. Ames, who not only gave his own time in going over the collection and carefully inspecting the labels, furnishing such as were missing, but also the service of his men in packing and shipping the plants. The collection was, until last summer, located at his greenhouses at North Easton. At that time, however, it was removed to a range of houses located some five miles from that place. To transport over this distance a collection of such size was not a small undertaking. It took six wagon-loads to accomplish it, the wagons being arranged to accommodate two tiers on each trip. Arrangements were made with the railroad company for a freight car which was placed on a siding. Staging was placed in the car, as the floor space was by no means adequate to accommodate the collection. Two tiers of staging were placed in one end and one in the other, and the smaller plants, packed in boxes, were placed on these. The larger plants were packed in hay on the bottom of the car. Unfortunately the selection of the car was a poor one, as it broke down in transit, and was located in a disabled condition at New Haven, where the contents were transferred to another car. The collection finally reached the Garden just one week after its shipment, fortunately suffering no harm whatever from the delay.

Owing to the crowded condition of the conservatories, this collection has been divided, a part of it, mainly the venus's-slippers (*Paphiopedilum* and *Phragmidepium*) and the cattleyas, being placed on the central bench in house no. 15 of the conservatories, while the remainder, for the present, is located in house no. 3 of the propagating range.

This collection, brought together at much expenditure of time and money, hardly needs comment as to its value. It is exceedingly rich, not only in genera and species, a feature of especial interest to a botanical garden, but also in hybrids, among which may be numbered some of great beauty and rarity. Among other interesting plants are many secured by Mr. Ames in his personal explorations in Cuba and in the southern parts of Florida, or by collectors whom he sent out especially in search of orchids. Many things have come to him from Mexico and other parts of Central America; and from the Philippines he has received many plants, some of these being the types of new species which Mr. Ames has recently described. All these interesting and valuable species are included in the gift to the Garden.

The collection is particularly rich in forms from the New World, this region being represented by about fifty-five genera and over four hundred species and varieties. Among the New World genera rare in cultivation are, among others, the following: *Hexadesmia, Schlimia, Mesospinidium, Aspasia, Trichocentrum, Trigonidium, Lockhartia, Cirrhaea, Amblostoma, Scuticaria, Dichaea, Lanium, Eriopsis*, and *Anguloa*. Those from the New World which are represented by five or more species or varieties are the following: *Maxillaria*, 24; *Cattleya*, 72; *Epidendrum*, 65; *Miltonia*, 7; *Schomburgkia*, 5; *Oncidium*, 40; *Sobralia*, 5; *Stanhopea*, 8; *Odontoglossum*, 22; *Brassavola*, 5; *Laelia*, 26; *Lycaste*, 10; *Phragmipedium*, 53; *Pleurothallis*, 17. This will indicate the value of the collection for a comparative study of forms from the new world.

The Old World is also well represented by about thirty-one genera and three hundred and sixteen species. Among those unusual in cultivation are: *Ceratostylis*, *Mystacidium*, *Spathoglottis*, *Listrostachys*, *Tainia*, *Neobenthamia*, *Otochilus*, and *Oberonia*. The following genera are represented by five or more species or varieties: *Eria*, 13; *Cirrhopetalum*, 10; *Sarcanthus*, 5; *Cymbidium*, 12; *Platyclinis*, 5; *Bulbophyllum*, 25; *Angraecum*, 14; *Coelogyne*, 20; *Dendrobium*, 52; *Vanda*, 11; and *Paphiopedilum*, 108. The genus last named contains the largest representation in the whole collection, and embraces some plants of great value, now rather difficult to obtain.

Of genera which are common to both the Old World and the New are: *Polystachya*, *Liparis*, *Vanilla*, *Spiranthes*, *Eulophia*, and *Microstylis*.

The entire collection contains about 1,530 plants, representing nearly 100 genera and about 750 species and varieties. A number of the genera and many of the species were not previously in the Garden collections. It is hardly necessary to state that the acquisition of this material adds greatly to the value of the Garden collections, not only for the purposes of study, but also from the viewpoint of beauty and decoration.

George V. Nash.

THE SELF-PRUNING OF TREES.

The natural pruning of trees has long been well known. By natural pruning is meant the loss of certain branches after their death, caused usually by overshading and consequent poor nutrition. Thus is explained the lack of lower branches on trees growing close together in a forest. In this process the tree remains passive until the branch is dead, after which the dead branch is cut off by the formation of a "collar" of tissue by the cambium. Trees that have been pruned by "nature," that is, as the result of the action of environmental forces outside the tree, yield lumber that is much freer from knots than that cut from trees growing in the open, where the lower branches have persisted, but natural pruning appears to be of little advantage in the economy of the plant.

Many trees, however, prune themselves. This phenomenon, though described by Foerst * in 1893, and more fully by Schaffner and Tyler, in the "Ohio Naturalist" for 1901, appears to be not widely known. This *self-pruning* is distinguished from natural pruning in that the tree itself is throughout the active agent in the process. The branch dies as the result of the pruning, rather than being pruned after it is dead. In some trees there is formed at the base of certain branches an abscission layer, like that formed at the base of petioles in leaf-fall, and thus the branch is severed from the tree.

A striking demonstration of self-pruning may now be had along the walks leading up to the museum building. The sapling poplars (*Populus deltoides*), that alternate with the tulip-trees on either side of the walk, are vigorously pruning themselves, and the fallen branches are so numerous as to attract general attention. Most of the pruned branches are two years old, though some are older and some younger. They bear numerous, well-formed winter buds, and in some instances many leaves still remain on the branch.

Self-pruning, in some families, is accomplished in other ways than the one mentioned above. In the willow, for example, instead of the abscission-layer, a brittle zone is formed at the base of the branch. Out of about twenty-five genera where self-pruning occurs, *Catalpa*, *Ailanthus*, horse-chestnut, elm, lilac and mulberry, may be mentioned as illustrative examples in the garden.

The significance of self-pruning seems to be quite analogous to that of artificial pruning, *viz.*, to get rid of superfluous or of weak branches. It does not seem to be a means of vegetative propagation, for in most cases the branches cut off either do not take root, or do not fall into conditions suitable for that. Some trees, as, for example, the red and the sugar maples, and the

* Bull. Torrey Club 19: 267. 1892. Ibid. 20: 157. 1893.

American elm, are self-pruned in the spring or early summer, while others, as the poplar, postpone the process until fall.

C. Stuart Gager.

THE TARDY DEFOLIATION OF THE TREES.

The significance of leaf-fall as a protection against excessive drought rather than against extreme cold, as is popularly supposed, is well shown in the late persistence of the foliage this fall. Normally, most of the deciduous trees and shrubs in the Garden are almost entirely barren of leaves by the last of October, but this year the foliage, though richly colored with autumn tints, has persisted until the last week in October, with almost no sign of falling. Some of the maples, the hornbeams, sweetgums, and even the plane-trees (which have already been once defoliated this season by a fungus disease attacking them in the spring), show, at a distance, almost no loss of foliage.

This fact is doubtless largely due to the copious precipitation during September. Seven and ninety-three hundreths inches of rain were recorded at the Garden last month, or almost one fifth of the entire average annual precipitation. Thus tardy leaf-fall is correlated with a tardy autumn and winter drought, and the several frosts that have occurred have not appreciably hastened defoliation. Of course loss of water by transpiration ceases some time before the leaf actually falls.

C. Stuart Gager.

NEW MUSEUM CASES.

The crowding of specimens resulting from the naturally uneven growth of the different parts of the museum during the last few years has necessitated an increase in the case equipment for both the public exhibits and the study collections. To meet this condition, a number of cases were recently constructed and set up under a contract of the Department of Parks. These represent several standard units, and are built of quartered oak to match the cases of their respective styles.

Six cases for displaying fossil plants have been placed in the west hall of the basement. These occupy positions relatively the same as similar cases in the east hall. Thus the entire exhibition space of the basement will be used for the display of fossil plants. As the space in the new cases is equivalent to that of the old ones, many of the more valuable and characteristic specimens of fossil plants that have accumulated for several years in storage, can now be put on exhibition.

Sixteen cases have been placed in the west wing of the economic museum. They were arranged to complete the eight standard blocks consisting of six cases each, thus using up the available space in that wing. The collections displayed in that portion of the museum can now be more satisfactorily developed. The added space will be taken up mainly by the exhibits of plant constituents, oils, beverages, spices, and tanning material.

Forty-one cases were added to the equipment on the top floor. As many cases as possible were placed in the main herbarium room in order to relieve the congested condition of the herbarium of flowering plants, which has been brought about chiefly by the addition of specimens secured by means of exploration and exchange. However, the majority of the new herbarium cases were arranged in the room at the extreme western end of that floor. Here the entire fungus herbarium is being installed, while the cases in the room formerly devoted to fungi will be used for the rapidly growing fern herbarium. This addition of cases enables us to arrange the public exhibits and the study collections of the Garden to much better advantage than was possible heretofore.

J. K. Small.

NOTES, NEWS AND COMMENT.

The bi-weekly botanical conventions of the Garden were resumed on November 6, and will be continued until June 1.

Mr. H. S. Jackson, of the State Experiment Station, Newark, Delaware, was at the Garden from November 4 to 6, consulting the herbarium.

Dr. L. M. Underwood, Professor of Botany in Columbia University and Chairman of the Board of Scientific Directors of the Garden, died at his home in Redding, Connecticut, on Saturday, November 16.

Dr. Raymond H. Pond, who has been studying at the Garden during the past year, sailed for Europe on November 7 to spend several months in visiting German botanical laboratories.

Dr. Murrill visited the Biltmore Forest School, at Biltmore, North Carolina, in October, where he secured collections of Polyporaceae and made some observations on diseases of trees.

Dr. M. A. Howe and Mr. Percy Wilson sailed for the Bahamas on November 15. They have planned to spend several weeks there in botanical exploration.

Dr. C. B. Robinson, assistant curator of the Garden since July 1, 1906, has been appointed economic botanist of the Bureau of Science of the Government of the Philippine Islands, and is planning to sail for Manila early in the coming year.

The regular autumn exhibition of the Horticultural Society of New York was held at the Garden on November 13 and 14. An attractive display of varieties of apples was a feature of the exhibition. At the meeting on November 13 addresses were made by Messrs. Hedrick and Fullerton.

Professor C. F. Baker, for three years past chief of the department of botany in the Estación Central Agronómica, at Santiago de las Vegas, Cuba, has been appointed curator of the herbarium and botanic garden at the Museu Goeldi, Para, Brazil. His special work there will be the further development of the herbarium and garden at Para, and the botanical exploration of some of the most interesting parts of the Amazon valley. Professor Baker visited the Garden on November 20, on his way to Brazil.

The brook running through the center of the herbaceous grounds, which was becoming wider than first designed by the squeezing out of soil from its sides into the water by the crowds of people walking along its banks, making it necessary to deepen it continually for several years, has been made permanent this fall by the construction of a loose stone wall along each side rising to about the water level; this construction will make the care of the grounds adjoining the brook much easier, and does not interfere in the least with the planting of aquatics.

A contract for the construction of the park wall and fence on the southwestern side of the Garden, extending from the Elevated Railway station to the Southern Boulevard entrance along the property line of Fordham University, was awarded by the Commissioners of Parks in October to Guidone and Galardi, who plan to begin work during November. The structure will consist of a low rubble stone wall surmounted by an iron fence broken at intervals by granite columns. A fence along this boundary line has long been greatly desired, inasmuch as the path running parallel with this line from the Elevated Railway station is used by thousands of people and the old stone wall which is at present there is no barrier. The contract price is $17,000, the total distance being about two thousand feet. The fence will be stepped at intervals in order to conform to the natural grades as much as possible, each section being horizontal. It was designed by Mr. John R. Brinley, landscape engineer of the Garden, in consultation with Mr. Samuel Parsons, landscape architect of the Department of Parks, and the design was approved by the board of managers of the Garden and by the park commissioner.

The total precipitation recorded at the Garden for October was 4.44 inches. Maximum temperatures were recorded of 74° on the 4th, 73° on the 7th and 18th, and 61° on the 23d; also minimum temperatures of 40° on the 2d, 34° on the 10th, 31° on the 21st, and 28° on the 27th. The first fall frosts occurred during the first week of the month.

ACCESSIONS.

LIBRARY ACCESSIONS FROM SEPTEMBER 1 TO OCTOBER 31.

ALPINO, PROSPERO. *Historiae Aegypti naturalis: pars prima.* Lugduni Batavorum, 1735. 2 vols. in 1.

ARCHER, THOMAS CROXEN. *First steps in economic botany.* London, 1854.

BABINGTON, CHARLES CARDALE. *Manual of British botany.* Third edition. London, 1851.

BACKHOUSE, JAMES. *Monograph of the British Hieracia.* York, 1856.

BARRÈRE, PIERRE. *Essai sur l'histoire naturelle de la France équinoxiale.* Paris, 1749.

BLACKSTONE, JOHN. *Fasciculus plantarum circa Harefield sponte nascentium cum appendice ad loci historiam spectante.* Londini, 1737.

BLACKSTONE, JOHN. *Specimen botanicum quo plantarum plurium rariorum Angliae indigenarum loci natales illustrantur.* Londini, 1746.

BOEHMER, GEORG RUDOLF. *Flora Lipsiae indigena.* Lipsiae, 1750.

BUXTON, RICHARD. *Botanical guide to the flowering plants, ferns, mosses, and algae, found indigenous within sixteen miles of Manchester.* London, 1849.

CLUTE, WILLARD NELSON. *Our ferns in their haunts.* New York, 1901.

CLUTE, WILLARD NELSON. *The fern allies of North America north of Mexico.* New York, 1905.

DALECHAMPS, JACQUES. *Histoire générale des plantes.* Lyon, 1615. 2 vols.

DAVIES, HUGH. *Welsh botanology.* London, 1813.

DAVY, HUMPHRY. *Elements of agricultural chemistry.* London, 1813.

DRURY, HEBER. *Hand-book of the Indian flora.* Madras, 1864–69. 3 vols.

DRURY, HEBER. *Useful plants of India.* Madras, 1858.

DUNBAR, WILLIAM PHILLIPS. *Zur Frage der Stellung der Bakterien, Hefen und Schimmelpilze im System.* München, 1907.

FORTUNE, ROBERT. *Journey to the tea countries of China.* London, 1852.

GANONG, WILLIAM FRANCIS. *The teaching botanist.* New York, 1899.

GARDINER, WILLIAM. *Flora of Forfarshire.* London, 1848.

GEDDES, PATRICK. *Chapters in modern botany.* London, 1893.

GENEVIER, L. GASTON. *Essai monographique sur les Rubus du bassin de la Loire.* Angers, 1869.

HARRIS, JOSEPH & MYERS, WILLIAM SHIELDS. *Food for plants.* New edition. New York, 1905. (Deposited by the Trustees of Columbia University.)

HARVEY, ALEXANDER. *Trees and their nature.* London, 1856.

HOOKER, JOSEPH DALTON. *Himalayan journals.* London, 1854. 2 vols.

HOUGH, ROMEYN BECK. *Handbook of the trees of the Northern States and Canada.* Lowville, 1907.

IRVINE, R. H. *Short account of the materia medica of Patna.* Calcutta, 1848.

ITERSON, GERRIT VAN. *Mathematische und mikroskopisch-anatomische Studien über Blattstellungen.* Jena, 1907.

Journal of the Institute of Jamaica. Vol. II., Kingston, 1894–99. (Given by Dr. N. L. Britton.)

KIRSCHLEGER, FRIEDRICH. *Prodrome de la Flore d'Alsace.* Strasbourg, 1836–38.

KIRSCHLEGER, FRIEDRICH. *Statistique de la flore d'Alsace et des Vosges, qui font partie de cette province.* Mulhausen, 1831.

KIRSCHLEGER, FRIEDRICH. *Statistique végétale des environs de Strasbourg.* (Strasbourg, 1845.)

KOCH, WILHELM DANIEL JOSEPH. *Synopsis der deutschen und schweizer Flora.* Zweite Auflage. Leipzig, 1846–47.

KRAMER, WILHELM HEINRICH. *Elenchus vegetabilium et animalium per Austriam inferiorem observatorum.* Viennae, 1756.

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MUSEUMS AND HERBARIUM.

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2 specimens of *Aralia hispida* from Quebec. (Given by Brother Louis Arsene.)

13 mosses from New Hampshire. (Given by Mr. H. H. Bartlett.)

1 specimen of *Solidago juncea* from Pennsylvania. (Given by Dr. Philip Dowell.)

3 mosses from Connecticut. (By exchange with Mr. George E. Nichols.)

1 specimen of *Polygonum tenue* from Minnesota. (Given by Mr. L. R. Moyer.)

5 specimens of ferns and mosses from Grenada, West Indies. (Collected by Mr. W. E. Broadway.)

2 mosses from Brazil. (By exchange with Professor V. F. Brotherus.)

207 mosses from the tropics. (Distributed by Mr. F. Renauld.)

2,000 specimens from Jamaica, West Indies. (Collected by Dr. and Mrs. N. L. Britton.)

14 specimens of flowering plants from Long Island. (Given by Dr. R. M. Harper.)

30 specimens "Musci Acrocarpi Boreali-Americani." (By exchange with Professor J. M. Holzinger.)

19 specimens of flowering plants from Colorado. (Given by Mr. H. L. Shantz.)

9 specimens of flowering plants from the Old World. (Given by Mr. H. D. House.)

6 mosses from the West Indies. (By exchange with Mr. J. Cardot.)

1 specimen of *Rasoumofskia pusilla* from Maine. (Given by Mr. J. Loring Arnold.)

2 specimens of *Fissidens* from Japan. (Given by Mr. E. B. Chamberlain.)

3 mosses from New England. (Given by Miss Annie Lorenz.)

54 specimens from South Carolina and Alabama. (Given by Messrs. H. D. House and W. C. Dukes.)

65 specimens of fungi from Biltmore, North Carolina. (Collected by Dr. W. A. Murrill.)

359 specimens from the Philippine Islands. (Collected by Mr. A. D. E. Elmer.)

PLANTS AND SEEDS.

102 plants for herbaceous grounds. (By exchange with Prof. W. J. Beal.)

1 plant for conservatories. (By exchange with Dr. J. N. Rose, through United States National Museum.)

43 plants for conservatories. (By exchange with Dr. C. F. Baker, Cuba.)

1 plant for conservatories. (Given by Miss A. M. Clark.)

2 plants for conservatories. (Given by Dr. Philip Dowell.)

1 plant for nursery. (Given by Mr. H. G. Rugg.)

3 plants for nursery. (Collected by Mr. R. C. Benedict.)

25 plants for herbaceous grounds. (Given by Mrs. W. Spalding.)

58 plants for conservatories from Jamaica. (Collected by Dr. and Mrs. N. L. Britton.)

20 plants for nursery. (Given by Mrs. K. L. Prentiss.)

packets of seed. (Collected by Mr. G. V. Nash, at Portage, N. Y.)

16 plants for conservatories. (Given by Mr. M. A. Saville.)

1 packet of seed. (Given by Dr. D. T. MacDougal.)

2 rootstocks for conservatories. (Collected by Dr. and Mrs. N. L. Britton in Jamaica.)

1 bulb for conservatories. (Collected by Dr. and Mrs. N. L. Britton in Jamaica.)

LUCIEN MARCUS UNDERWOOD.
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THE WORK OF PROFESSOR LUCIEN MARCUS UNDERWOOD.

The success of a life work is measured by the character and extent of its influence. When this work is embodied in the form of such voluminous records for permanent reference as have been left by Professor Underwood, it is important that its characteristics should be generally recognized. This is the more necessary in the present instance, because interest in many of the subjects treated by this author is yet in its infancy, and the work known to but few in comparison with those who will in future require its assistance.

A complete bibliography of Professor Underwood's writings is in course of preparation by another; it is the purpose of the present contribution to make use of only such references as shall illustrate the peculiar character and value of his work in general.

Professor Underwood was born on the 26th of October, 1853, at New Woodstock, New York, of John Lincklaen and Jane H. (Smith) Underwood. He died at his home in Redding, Connecticut, November 16, 1907, and was buried in the Redding cemetery. A copy of his latest photograph, taken a short time before his death, is shown in the frontispiece. His boyhood was passed upon the farm and his subsequent love of natural history was here foreshadowed in his interest in living things and in the keen and inquiring intelligence with which he observed them. During his student days these propensities were notable to his schoolmates, even to those who were not interested in the same subjects. His natural history collecting might be said to have begun spontaneously, in his boyhood, before he knew anything of such work as a pursuit. It began systematically as soon as his student life had given him a knowlege of this branch of study, and, before he had received his collegiate degree, his collections were already of considerable extent and of no little local value. The wide range of these collections, through animate and inanimate nature, plainly indicated the character of his mind and the nature of his future work as a teacher and investigator. His interest in the inorganic world extended to chemical composition, so that chemistry early become one of his favorite studies, and he spent some time in teaching it. When he took the degree of Ph.D. at Syracuse University in 1879, he was recognized by both faculty and students as a young man of many broad attainments. These facts are here dwelt upon by virtue of their relation to what the writer regards as Professor Underwood's special characteristic, breadth of view.

From these habits of study, it resulted that his superiors felt able to assign him, at different times, to a wide variety of teaching duties. He once informed the writer, with a smile of amused reminiscence, that he had taught about everything that could, with any degree of grace, be crowded within the range of work of any one teacher. The many positions which he occupied as a teacher indicated neither restlessness nor incompetence, but a determination to settle only where there was opportunity for the pursuit of his real life work. This opportunity he secured in 1896, when he became Professor of Botany at Columbia University, and assumed important associated relations with the New York Botanical Garden as a member of its Board of Scientific Directors, of which he became Chairman in 1901. His opportunities here were enhanced by the possession of unexcelled assistance in the teaching department of the University, making it possible for him to work in freedom from many of the distractions which often impede the work of the scientific investigator.

Professor Underwood's first actual scientific publication seems to have been an account of original observations of the evergreen wood fern (Bulletin Torrey Botanical Club, October, 1878).

This published observation was but one of the many which he had treasured, and, the ice being now broken, he became disposed to direct attention to the ferns generally as he knew and loved them, which he did in 1881, through a small volume entitled "Our Native Ferns." The volume was dedicated to his sister, and its title page bore the following quotation from Coleridge:

> "He prayeth best who loveth best
> All things, both great and small,
> For the dear God who loveth us,
> He made and loveth all."

The work contained synoptical descriptions of 147 species, and its object was to guide to their study as well as to their classification. This work has passed through six editions, the fourth of which represents a notable advance in the author's view and in his treatment of the subject; it includes the fern allies, and adopts a modern classification and a rational nomenclature. That it created a widespread interest in the study of ferns is shown by the successful career of the Fern Chapter and Fern Bulletin, both of which profited largely thereby. A more striking evidence is the great number of fern specimens that soon poured in upon the author from students in all parts of the country, which enabled him to accumulate a very valuable collection, now possessed by the New York Botanical Garden.

During the progress of his work on ferns, Professor Underwood became impressed with the need for some systematic presentation of the North American Hepaticae, which, serving as a convenient guide, might lead to the more general study of this neglected group. This project was carried out in 1883, when he published his descriptive Catalogue of these plants in the Bulletin of the Illinois State Laboratory of Natural History.

One of his most cherished objects was the publication of an elaborate Index Hepaticarum, and in 1893 its first part, on bibliography, appeared. It is characteristic of the author that this first part is presented so that it can form a convenient basis for the continuation of the work by another. In 1894, he published a highly scientific paper on the evolution of the Hepaticae.

Professor Underwood's natural tendency to breadth of study was illustrated in his relations with the work of the Indiana Academy of Sciences. This society was established in 1885 and the publication of its Proceedings was begun in 1891, the first volume containing two papers by him. In that year he proposed the undertaking of a biological survey of the state. The following year he was made chairman of a committee to provide for its organization, with the result that in 1893 the Proceedings contained a report of work covering 192 printed pages. Of these, 55 were by Underwood, and the remainder by a number of contributors, indicating his influence in enlisting the interest of others, an ability that characterized his entire career. In this first report, he published a map of Indiana, with those counties shaded in blue from which no collections of ferns or fern-allies had been reported, the area thus covered representing about three fifths of the state.

The same idea of making provision, where none existed, for encouraging new interest in little-worked fields of study led him in 1899 to publish a work entitled "Moulds, Mildews and Mushrooms." The author's idea was expressed in the following prefatory statement: "The increasing interest that has been developed in fungi during the past few years, together with the fact that there is no guide written in the English language to the modern classification of the group and its extensive but scattered literature, has led the writer to prepare this introduction for the use of those who wish to know something of this interesting series of plants." In accordance with this idea, guides to the literature here accompany his exposition of all the groups. Two years earlier, he had published his "Preliminary List of Alabama Fungi." It would perhaps be too much to say that the author's interest in fungi had been incited by economic considerations, but these unquestionably had much to do with his special study of them. The publication of his studies of the cedar-and-apple rust proved of great interest in horticultural circles. In 1896, he published, in coöperation with Earle, an important paper on the "Treatment of Fungous Diseases," in the Bulletin of the Alabama Agricultural Experiment Station. About 1902, he became interested in the establishment of mycological clubs throughout the country, the work of these organizations being largely economic. It is doubtless due to the fact that most of Professor Underwood's work dealt with groups having few economic relations that his interest in vegetable economics was not more generally known. The writer is better informed, through long and intimate acquaintance, and has been for several years past impressed with a belief that he contemplated some important publication on economic botany.

During the entire period that these other studies, so fruitful of results, were occupying his attention, Professor Underwood was making steady progress in his investigations of the ferns. It is this which we regard as his special work, and it is to it that we must look for our best knowledge of him as a scholar. We have seen how, in the fourth edition of his fern manual, he broke from old traditions and thenceforth pursued his work with greater freedom to discover the truth and intelligibly present it. It was a momentous change, and one that marks the beginning of his best work. It gave to his views concerning the inter-relations of the North American ferns that unique value, the recognition of which weighs us down with the special sense of our loss, in that we shall never see the full results of its influence in their systematic arrangement. It forced him to go backward as well as forward in his researches, one of which was represented by a critical paper published in 1899 on the genera of ferns proposed prior to 1832. A little gem, which may be credited to the same impulse, was his paper of 1905, entitled "A Glimpse at Early Botanical Literature"; it had led him in 1901, in a paper entitled "A Changed Conception of Species," to say the following: "Two pernicious principles early invaded the study of botany in this country, and some traces of the spirit they engendered still persist in conservative settlements, along with other provincialisms strikingly un-American: (1) the habit of regarding as many American species as possible identical with European congeners . . . ; (2) the more or less blind acceptance of European writers on American plants as 'authorities.'" This position was more definitely stated a year later in a paper entitled "Some Features of Future Fern Study." Herein he refers to observations carefully recorded at Kew in 1898, and treats of the advance that will be made in the future study of our American ferns, viz.: "the delimitation of closely allied species that have hitherto been tied up in specific groups under single names." He speaks also of what will be "a very conspicuous feature of the fern study of the next few years," that is, of the early stages of our native ferns. He refers to the value of anatomical studies as casting light upon systematic relationships. The writer had knowledge of much deeper problems concerning the significance of fern anatomy which occupied our author, problems indicating such questions as "What is the frond," and "What is the relation of the fern caudex to the ordinary stem." In the paper here considered he speaks of the broadening of our present limited conceptions of American ferns by including those of the American tropics. "But these thoughts," he says, "take us far beyond the original intent of my subject; yet they only emphasize the fact that the world is a unit, and that even in fern study we will do well to bear in mind not to become too narrow in our conceptions."

The attitude of Professor Underwood toward fern study at the time of his death is to be seen in the following quotation from his very last paper: "The two ferns of the genus *Lindsaea* here to be described, one from Colombia, the other from Cuba, we regard as very distinct and readily recognizable; otherwise we should hesitate to add to the list of names in a genus so thoroughly in need of careful revision."

As a summary, from a careful review of this whole field of labor, it may be said that Professor Underwood's systematic study of the ferns was one of the most profound in its class, and was performed in a manner to compel the admiration of all competent critics. Convinced that the existing views of inter-relationship among the ferns were not only confused, but wrongly founded, and that correction could be accomplished only through a general readjustment, he undertook this enormous task without faltering, although he did not in the least lack appreciation of its magnitude. Although he dissected unsparingly the work of others, his sense of responsibility as a critic was so keen as to save him from any tinge of offensiveness, and he was never were all transferred to a shelter house located within the experiknown to yield to the personal in viewing either another's work or his own. In his studies, he was equally appreciative of the general and the detailed, and he balanced the two in a way that is very rare among systematists.

In work of this kind, every conclusion reached becomes the key to other questions, so that the publication of a group always represents the accomplishment of much more than appears in the publication. It is thus true that by far the larger part of Professor Underwood's results are recorded only in the herbarium cases where his annotated specimens are arranged. When one shall appear who is ready and able to take up this work where Professor Underwood has left it, he will find it no light task to prepare himself by traversing the ground already covered and by bringing himself to a point where he can compass Professor Underwood's view.

H. H. Rusby.

THE EVAPORATING POWER OF THE AIR AT THE NEW YORK BOTANICAL GARDEN.

In May, 1900, three meteorological stations were established in the Garden.* Station 1, located in the Herbaceous garden, was equipped with a standard rain-gauge, a thermograph, and a set of maximum and minimum thermometers. Station 2 was on a low ridge in the center of the hemlock forest, and station 3 in the central portion of the elevated plain of the fruticetum. The last two stations were equipped with thermographs only.

Late in September, 1904, these three stations were abandoned.† The catchment basin of the rain-gauge was installed on the roof of the Museum building over the physiological laboratory, and, by means of a lead pipe extending down through one of the supporting pillars, it was connected with the gauge at the base of the pillar, inside the laboratory. The amount of precipitation recorded at the new station was found to be approximately the same as at the old one. The thermometers and thermographs

*Journal N. Y. Bot. Garden 1: 76. 1900.
†Journal N. Y. Bot. Garden 5: 211. 1904.

ment-garden, near the propagating-houses, on the eastern border of the garden.

Until June, 1907, the meteorological records at the garden include only the dates and amounts of precipitation, and the temperature of the air and that of the soil at two depths. The amount of precipitation, however, is not an index of the amount of water available to vegetation. Part of the meteoric water drains away through the soil before it is used, while a portion of it evaporates from the surface of the soil into the air. It is the ratio between annual precipitation and evaporation that chiefly determines how nearly a given region approaches to either a swamp or a desert. In a swamp evaporation is less than precipitation, while in a desert the reverse is true.

It is a well-known fact that the rate of evaporation from a given area depends upon the relative humidity of the surrounding air. Relative humidity, in turn, varies with the temperature of the air, and with the environment. Thus, for a given air-temperature, the rate of evaporation from a given water-surface will vary with the area of the surface and with the depth of the water, and the rate of evaporation from moist substances will be modified by the nature of the substance, and with the amount of moisture it contains. Thus, for example, water will evaporate more rapidly from one square foot of water-surface than from two square feet, and more rapidly from one square foot with a depth of, say, one quarter of an inch, than it will from the same area over a depth of one foot. Also the same amount of water will evaporate at different rates from clay-soil and from sand-soil. Shrubbery and foliage tend in several ways to increase the relative humidity of the surrounding air, thus retarding evaporation.

The experiments described in this paper form part of a more extended investigation, inaugurated by Dr. Burton E. Livingston, of the Desert Botanical Laboratory, of the Carnegie Institution, at Tucson, Arizona. Evaporimeters of uniform pattern, and standardized, have been distributed to some twenty-seven stations in the United States, ranging from Orono, Maine, on the east, to California, on the west, and from Bozeman, Montana, on the north, to Gainesville, Florida, on the south, covering a wide range of altitude and of nearness to large bodies of water. Of these instruments, those received at the garden were Nos. 28, 30 and 34. It is hoped by means of the investigation, to be able to establish a unit for measuring evaporation.

On the sixth of June, 1907, the evaporimeters were installed at three stations within the Garden. These instruments consist of a pint fruit-jar, tightly corked with a cork stopper soaked in paraffine. Through the stopper a glass tube extends from the oottom of the jar up and through a second cork, which tightly closes the opening into a porous clay thimble. The glass tube extends to the top of the thimble. For further protection against the entrance of water from without a paraffined piece of cloth was fitted tightly around the glass tube, and extended as a roof over the top of the fruit-jar.

The jar was filled with distilled water up to a zero mark, and the porous thimble and the glass tube were also filled with distilled water. Each evaporimeter was sunk into the ground to the level of the top of the fruit-jar. As evaporation took place from the surface of the thimble the water rose from the jar up through the glass tube, thus keeping the thimble full and lowering the surface of the water in the jar. The rate of evaporation varied with the relative humidity of the surrounding air, and the amount was measured by carefully pouring more distilled water into the jar from a graduate, until the water-surface in the jar rose again to the zero mark. The amount of water necessary to accomplish this was the measure of the amount of evaporation for the given period.

Station 1 (evaporimeter No. 28) was west of the propagating houses on a dry, rocky knoll, covered with only a thin layer (one to two feet) of soil, and well drained. The instrument was shaded on all sides by tall saplings of red cedar and *Ailanthus*, and numerous small herbaceous plants and vines such as *Smilax rotundifolia*, and ferns. The surface of the ground was covered with twigs and dead leaves. Station 2 (evaporimeter No. 30) was about fifty feet south of the stable, near the eastern border of the garden. The ground is low, poorly drained, and marshy during the spring and other periods of "wet weather." The instrument was surrounded with unmoved grassy sod, shaded by a tall sapling of alder on the west, and by tall shrubbery (*Forsythia*, etc.) on the east. Station 3 (evaporimeter No. 34) was about six feet east of the instrument shelter in the experiment garden (Fig. 37). On the north and west was sod, on the east and south

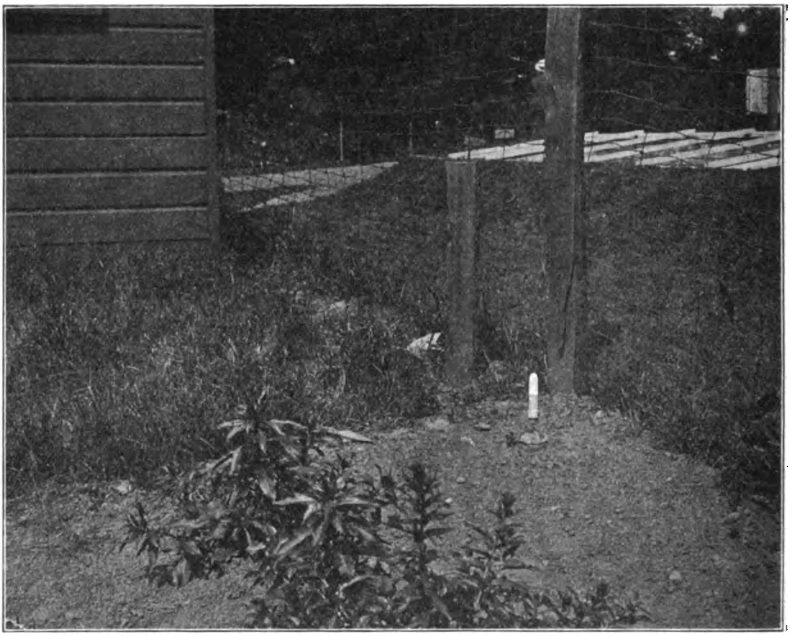

FIG. 37. Evaporimeter-Station 3. (*Instrument No. 34*) New York Botanical Garden. Facing nearly due west. The photograph shows the above-ground portion of the evaporimeter near the tall fence post. Evaporation takes place only from the upper (whiter) part of the porous clay thimble. The top of the fruit-jar which is sunk into the ground is covered by the paraffined cloth "roof," through which the glass tube passes from the jar up into the clay thimble.

cultivated ground, with evening-primroses growing within two feet. The soil here is loamy and well drained.

The instruments were all standardized by Dr. Livingston, so that, after applying the correction for each instrument, the respective readings were strictly comparable, varying only with the external conditions that control evaporation. Readings, taken every week on Monday morning from June 6, to October 14, and standardized by applying the necessary correction constant, are given in the following table:

Week ending,	6/10	6/17	6/24	7/1	7/8
No. 28,	66	77	99	60	77
No. 30,	48	48	51	29	47
No. 34,	—	129	147	106	137
Week ending,	7/15	7/22	7/29	8/5	8/12
No. 28,	99	60	130	98	82
No. 30,	55	37	56	37	46
No. 34,	129	124	185	133	142
Week ending,	8/19	8/26	9/2	9/9	9/16
No. 28,	126	105	118	47	74
No. 30,	89	64	85	32	41
No. 34,	188	131	128	41	85
Week ending,	9/23	9/30	10/7	10/14	
No. 28,	50	50	99	68	
No. 30,	27	—	32	—	
No. 34,	58	35	80	61	

It has been ascertained by Dr. Livingston that an evaporation of 6.05 c.c. from the evaporimeters corresponds to 1 mm. of depth, or, in English units (since it is customary to measure precipitation in inches), 153.67 c.c. of evaporation equals 1 inch of depth. For the purpose of ascertaining this data comparisons were made between the evaporation from the evaporimeters and from a chemical water-bath, 25.6 inches in diameter, with the water standing 11 cm. deep when the surface is at zero on the scale. "It stands," writes Dr. Livingston, "with the water-surface level with the middle of the evaporimeters to be tested, and about two meters away from them. It is about 15 cm. from the ground to the water-level. This level is about 5 mm. below the level of the dish at the beginning of a period, and the vessel is refilled once a day when the readings are made."

The total precipitation registered at the garden from June 10, 1907, to September 23, 1907, was 9.32 inches. This amount will be approximately the same for all three evaporimeter stations. Therefore, taking the difference between the amount of precipitation in inches and the amount of evaporation from the evaporimeters in inches, we have:

For No. 28 (at the propagating house)...........	9.32 in. — 8.47 in. =	.85 in.
For No. 30 (at the stable)............................	9.32 in. — 4.84 in. =	4.48 in.
For No. 34 (at the experiment garden)...........	9.32 in. — 12.10 in. =	— 21.42 in.

That is, at the propagating house precipitation was .85 inch in excess of the loss from the evaporimeter, at the swampy region near the stable, 4.48 inches; while in the experiment garden during the same period the evaporating power of the air was 2.78 inches in excess of the precipitation recorded.

Now it should be kept in mind that the loss of water from the evaporimeters is not a measure of the amount of water lost by the soil through evaporation, but is *only an index of the evaporating power of the air* for the given station. For the same locality the rate of evaporation from soil and from evaporimeter will materially differ, being less from soil and varying with its nature and condition, as well as with the surroundings above the soil-surface.

The purpose of the above data, therefore, is not to give a measure of the amount of precipitation that remains in the soil, or that becomes available to the plants, but, as already emphasized, to give a measure of the evaporating power of the air in different localities. The above record, then, gives *numerical expression* of the fact that, of the three localities studied, the evaporating power of the air is greatest in the experiment garden, least at the swampy area near the stable, and intermediate on the elevated, shaded, and well-drained rocky knoll.

C. Stuart Gager.

NOTES, NEWS AND COMMENT.

Mr. George V. Nash, Head Gardener, delivered a lecture on Water Gardens before the Bronx Society of Arts and Sciences December 6.

Bulletin No. 14, containing an enumeration by Henry H. Rusby of plants collected in Bolivia by Miguel Bang, with descriptions of new genera and species, was issued December 7, 1907. This number also contains an index to Vol. 4, which it completes.

A tuber of *Ibervillea Sonorae*, a member of the gourd family, collected in Mexico in February, 1902, and placed in the museum here soon afterwards, has shown signs of life again this season by sending up a slender stalk, which still appears green and to some extent active. This curious desert plant may be seen on the second floor of the museum building near the main stairway.

The road leading from the eastern end of the Long Bridge northward along the Bronx River to the Newell Avenue entrance at the Williamsbridge end of the garden was completed and thrown open for use in November, a steam road roller being obligingly detailed for its completion by the Hon. Joseph I. Berry, Commissioner of Parks. This portion of the driveway system is a little over 2,000 feet in length and the roadway has been built 25 feet wide. It will be possible to broaden it in the future in case this should be found necessary, but it is not expected that it will be used as much as the main 40-foot driveways and it is hoped that the 25-foot width will answer all purposes. Considerable grading of banks has been done from time to time along this road, but much of this work still remains to be accomplished. The road skirts the river north of the Long Bridge for about 700 feet and beyond that skirts the eastern side of the north meadows. The opening of this road completes the driveway system of the northern part of the ground.

The paths through the shrub collection on the plain north of the lakes, and those encircling the lakes, were completed during the autumn, a total length of over a mile of finished path being thus added to the system. Nearly all the grading necessary along the sides of these paths had previously been done. The paths through the economic garden and connecting this plantation with the paths leading to the Museum Building and to the systematic herbaceous plantation, a total length of nearly 2,000 feet, were also completed, as well as the path leading from the herbaceous garden in a southerly direction to the Bronx Park in the woods at the southern boundary of the garden, a distance of about 800 feet. This work was all made possible by securing a boat load of fine trap rock screenings through the Department of Parks. The same boat load of trap rock screenings furnished material for the resurfacing of the driveways first built in the Garden from the Bedford Park Boulevard entrance past the Museum Building, and northward to the lakes, and southward to a point east of the public conservatories; a considerable amount of the earlier built paths about the public conservatories being also re-surfaced. The entire road and path system of the grounds, constructed up to the present time, may now be reported to be in first class condition. The portion of the main driveway at the Lake Bridge, which has remained unfinished since the building of that structure awaiting the complete settling of the earth and rock filling, a length of about 250 feet, was also completed during November, as well as the paths leading to that bridge both from the north and from the south.

Meteorology for November. — The total precipitation recorded for the month was 5.03 inches. Maximum temperatures were recorded of 62° on the 3d, 58.5° on the 5th and 10th, 54° on the 17th, 58° on the 22d, and 55° on the 28th; also minimum temperatures of 29° on the 1st, 30° on the 5th, 23° on the 15th, 32° on the 20th, and 25° on the 30th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

432 specimens from North Dakota. (By exchange with Dr. J. Lunell.)

3 specimens from Virginia. (Given by Mr. E. B. Bartram.)

3 specimens of hepatics from New England. (Given by Miss Annie Lorenz.)

1 specimen of the wood of *Cotinus americanus* from Alabama. (Given by Dr. R. M. Harper.)

1 specimen of European spruce gum from Poughkeepsie, New York. (Collected by Mr. Percy Wilson.)

39 specimens from Colorado. (By exchange with Mr. George E. Osterhout.)

99 specimens of ferns from the Eastern States. (Given by Mr. R. C. Benedict.)

2 specimens of ferns from Chapel Hill, North Carolina. (Given by Professor W. C. Coker.)

1 specimen from Colorado. (Given by Professor T. D. A. Cockerell.)

7 specimens of mosses from New England. (Given by Miss Annie Lorenz.)

1 specimen of *Cercospora pachyspora* from Ohio. (By exchange with Professor W. A. Kellerman.)

2 specimens of polypores from Ithaca, New York. (Given by Professor George F. Atkinson.)

36 specimens of fungi from Virginia. (Collected by Dr. W. A. Murrill.)

1 specimen of *Solidago* from Michigan. (Given by Mr. William T. Wallace.)

2 specimens of *Lactarius* from Gainesville, Florida. (Given by Mr. H. S. Fawcett.)

3 specimens of polypores from Rockville, Indiana. (Given by Mr. Geo. T. Howell.)

1 specimen of *Porodaedalea Pini* from Forked River, New Jersey. (Given by Mr. W. H. Ballou.)

34 specimens from Colorado. (Given by Mr. H. L. Shantz.)

25 specimens of fungi from various localities. (Given by Miss S. L. Clarke.)

2 specimens of polypores from Staten Island, New York. (Given by Mr. S. C. Edwards.)

1 specimen of *Fissidens minutulus* from Cambridge, New York. (Given by Mr. Frank Dobbin.)

2 specimens of *Androsace* from New Mexico. (Given by Prof. E. O. Wooton.)

9 specimens of mosses from Connecticut. (By exchange with Mr. Geo. E. Nichols.)

45 specimens of violets from Connecticut. (Given by Mr. W. W. Eggleston.)

PLANTS AND SEEDS.

4 plants for conservatories. (By exchange with Dr. Treub, Java.)

59 plants for conservatories. (Given by Mrs. George Such.)

1 plant for conservatories. (Collected by Mr. L. J. K. Brace.)

1 plant for nursery. (Given by Mr. Sturtevant.)

1 plant for conservatories. (Given by Prof. P. H. Rolfs.)

2 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 plant for conservatories. (Given by Dr. H. H. Rusby.)

48 plants for conservatories. (By exchange with Estación Central Agronómica, Cuba.)

48 plants derived from seed from various sources.

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JOURNAL

OF

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VOLUME IX, 1908

PUBLISHED BY THE AID OF THE

DAVID LYDIG FUND

BEQUEATHED BY CHARLES P. DALY

JOURNAL

OF

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EDITOR

WILLIAM ALPHONSO MURRILL

Assistant Director

VOLUME IX

WITH 12 PLATES AND 39 FIGURES

1908

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JOURNAL

OF

The New York Botanical Garden

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THE COLLECTIONS OF FUNGI.

The fungus collections of the garden are arranged in two series, one in the museum of systematic botany on the second floor of the museum building, and the other in the mycological herbarium room on the floor above. The former is for the benefit of the general public, the latter for the use of students only.

The public museum collection, consisting at present of about 700 separate exhibits, is installed in 20 cases and 50 swinging frames, arranged in five blocks each, as shown in the accompanying plan (Fig. 1). Specimens are mounted on blocks or cardboard or in frames, or are preserved in alcohol or formalin. Photographs and colored drawings form an important part of the collection. Two cases, with 70 exhibits, are devoted to the smuts and rusts; and two cases, with 45 exhibits illustrate the coral-fungi, the hedgehog-fungi, and closely related groups. The large and conspicuous polypores fill six cases, with 185 exhibits; while the gill-fungi, very perishable plants, occupy at present only one case, with 55 exhibits. Many colored drawings of agarics, however, are now being mounted in the swinging frames. The puffballs are well represented in a separate case by 45 exhibits. The chestnut disease so prevalent about New York is also exhibited in a single case. Four cases are devoted to the lichens, with 120 exhibits; and the sac-fungi and imperfect forms, with over 100 exhibits, are shown in the remaining three cases.

The study collection of these plants, consisting of about 160,-000 specimens, has been recently removed to a large room over

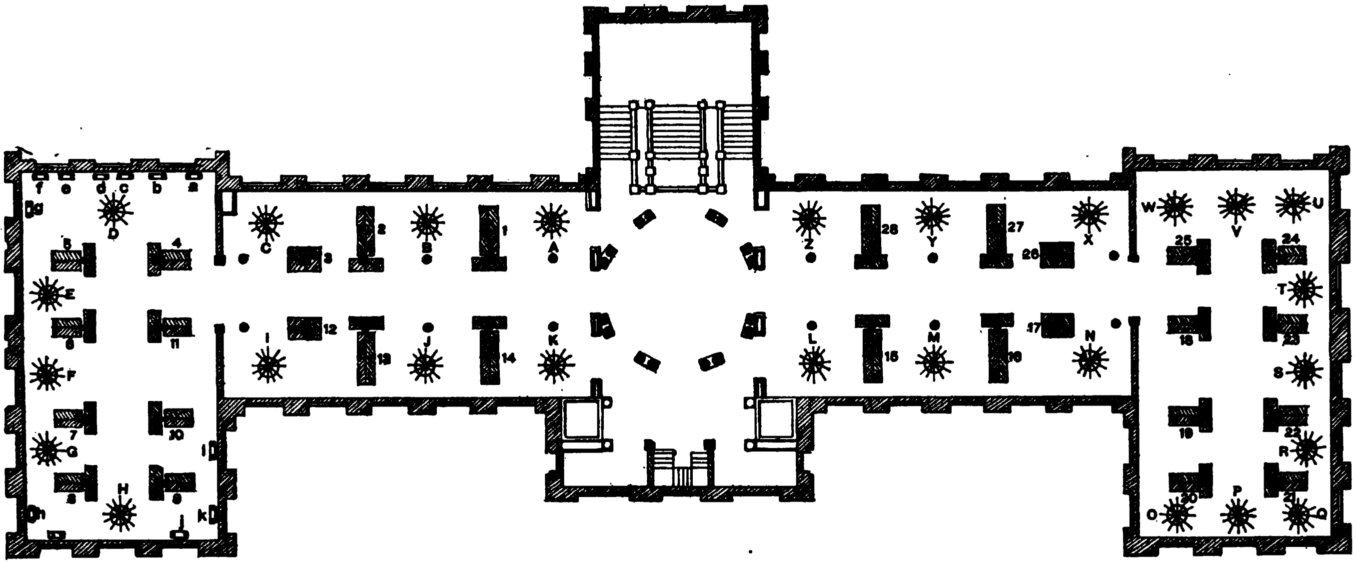

FIG. 1. Floor-plan of the museum of systematic botany. Blocks of cases 4 to 8 and swinging frames *D* to *H*, occupying most of the west wing, are devoted to the fungus exhibits.

forty feet long and nearly thirty feet wide at the northwestern corner of the building, where thirty new herbarium cases have been installed to receive it.

A general idea of the arrangement of the herbarium may be gained from the accompanying plan. The six central blocks of four cases each contain the regular groups of fungi in series, ten cases being devoted to moulds, sac-fungi and imperfect forms, two to smuts and rusts, and twelve to the higher groups. The side cases contain the synoptical collection, duplicates, and miscellaneous specimens. At one end of the room are desks and

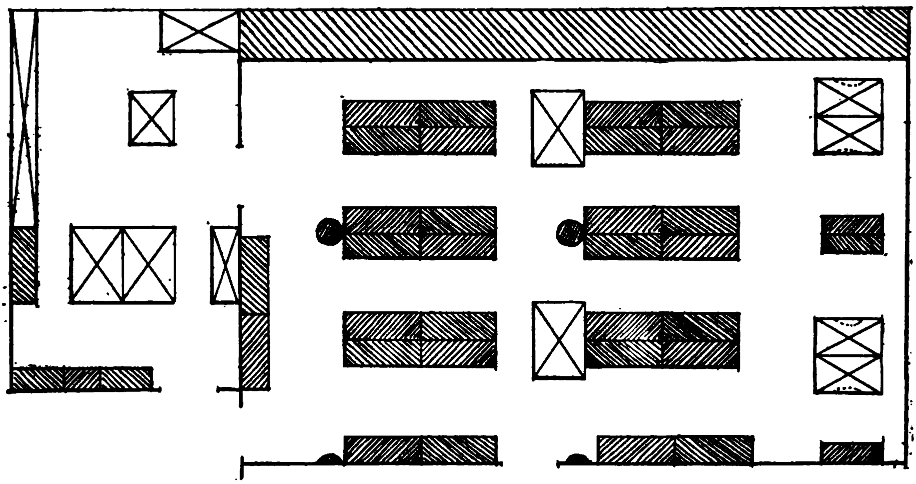

FIG. 2. Plan of the Mycological Herbarium.

other equipment for the use of students, and in the center large tables for laying out specimens. At the other end is the office of the curator in charge of the fungi.

The original Ellis collection of 80,000 specimens was purchased in 1896, and his residual collection of 20,000 specimens in 1900. Since that time the Garden has obtained an average of over 8,000 specimens a year, making a total of 60,000 acquired in the past seven years.

Mr. Ellis was at work upon his collection for forty years, during which time he not only collected extensively himself, but received material from all parts of this country and many parts of Europe for determination and exchange. More species of fungi were described by him than by all other American botanists together, and the types, or orginal specimens, of these species were all preserved in his collection. Among the contributors whose names frequently appear, the following are perhaps the best known: Messrs. H. W. Ravenel, A. B. Langlois, G. Martin, W. W. Calkins, S. H. Demetrio, E. Bartholomew, E. Bethel, F. W. Anderson, W. C. Carpenter, H. W. Harkness, C. L. Smith, A. P. Morgan, B. M. Everhart, A. Commons, J. Macoun, J. Dearness, A. C. Waghorne and Charles Wright.

Since 1900 there has been no very large single collection of fungi added to the herbarium, but specimens have been derived from many different sources, chiefly through material sent in for determination and through explorations conducted by members of the Garden Staff. Certain groups that were poorly represented in the Ellis collection, such as the gill-fungi and many of the large wood-loving species, have recently been collected in great quantities in Maine, New Hampshire, New York, New Jersey, Pennsylvania, Virginia, North Carolina, and Florida; and in the Bahamas, Cuba, Porto Rico, Jamaica, Costa Rica, Honduras, and other parts of tropical America.

Among those not connected with the Garden who have assisted in building up the mycological herbarium in recent years, are the following: Messrs. E. W. D. Holway, H. J. Banker, F. E. Clements, C. F. Baker, T. D. A. Cockerell, W. Trelease, G. F. Atkinson, F. S. Earle, A. D. Selby, L. Abrams, J. J. Davis, S. M. Tracy, A. A. Heller, F. E. Lloyd, C. F. Millspaugh, D. Griffiths, W. A. Kellerman, E. C. Howe, A. Nelson, R. M. Harper, W. C. Barbour, C. W. Dawson, E. Bartholomew, G. P. Clinton, D. R. Sumstine, C. V. Piper, P. L. Ricker, C. H. Peck, E. R. Memmimger, C. C. Hanmer, A. O. Garrett, J. Macoun, L. Romell, A. J. Hill, W. E. Broadway, N. M. Glatfelter, M. E. Peck, W. R. Maxon, D. S. Johnson, A. D. E. Elmer and C. H. Demetrio; and Misses A. Eastwood, S. F. Price, V. S. White, M. L. Overacker and G. S. Burlingham.

Important European collections have been recently obtained from Abbé G. Bresadola, of Trient, Austria-Hungary, and from Mr. George Massee, of Kew Gardens, England. Sets of current European exsiccati are purchased as they appear.

Considerable attention has also been given to the collection of oriental species in certain groups. Very valuable material was acquired by Mr. R. S. Williams, assistant curator, during his explorations in the Philippine Islands, and this has been extensively supplemented by Philippine specimens sent in for determination.

Most of the specimens of groups below, and including, the rusts are mounted in packets glued on herbarium sheets such as are used in the herbarium of flowering plants. The higher groups, however, contain many bulky specimens which must be preserved in boxes, and these are in most herbaria kept in a separate series, entailing much extra labor and no little inconvenience. In order to avoid the double series here, we have had light wooden drawers made to fit the compartments in the herbarium cases and into these, in their regular order with the sheets, the boxes containing the larger specimens are placed. These drawers have the additional advantage of protecting against dust and insects, and, on the whole, appear to solve the problem as well as could be desired. Any one who has attempted to handle loose boxes in quantity will welcome some such convenient arrangement as this.

For ready reference in the comparison of these bulky specimens and for the use of students consulting the herbarium, a synoptical collection is being arranged in alphabetical order in boxes glued on cardboard, each box containing good representative specimens of a single species, with as many variations as are obtainable. This arrangement will save much time and will largely prevent the usual wear and tear and displacement of specimens in the regular collection.

In the fungus collection are many field notes of great value relating to the size, color, form, etc., of the plants when fresh. These, with photographs and colored drawings when obtainable, are pasted on the herbarium sheets or placed in the boxes, the idea being to keep everything relating to a given specimen as close to it as possible. The same disposition is also made of notes taken in foreign herbaria, characters obtained from microscopic study, and letters containing information regarding habitat, distribution and other points of interest. A collection of autograph letters from mycologists and collectors is kept separately for reference in case the identity of labels or miscellaneous data is in doubt.

Specimens preserved in alcohol or formalin are desirable in some groups, but no attempt is made to preserve any large number in this way except for special studies in morphology or for museum purposes, as such a collection is of doubtful value in taxonomic work, especially when one considers the immense amount of time, space and money involved.

The preservation of fungi against insects has always been a difficult problem for the curator. Many methods have been tried in various herbaria without complete success. Carbon bisulfid has been mainly used in this country, but the results are not satisfactory. Corrosive sublimate, so extensively employed for flowering plants, is not only valueless but decidedly harmful to many of the higher fungi, since it alters or destroys their surface characters and often changes their substance to a marked degree. It is much better to lose some specimens than to have the whole collection thus altered. In the case of large woody specimens, also, it is very difficult to secure sufficient penetration to preserve the interior portions.

The substance I have used with great success is naphthalene flake, of the best quality. Experiments conducted here have shown that adult insects are killed in a few hours when placed in a box with this substance, and it is probable that those emerging from the pupa stage succumb in less time. Specimens are treated when first obtained, and those peculiarly susceptible are kept in an atmosphere of naphthalene more or less all of the time. In going through the collections, when a packet or box is found containing insects, a spoonful or more of naphthalene is added and the incident closed. Possibly there are insects not yet acquired or some that do not thrive in this region that are not amenable to this treatment, but it has been more satisfactory here so far than any other method I have seen tried.

All fungi found upon leaves are treated with corrosive sublimate. This is done chiefly to preserve the leaves intact, the fungi being so small that, with few exceptions, insects would hardly do them serious damage. All other fungi, particularly the conspicuous forms known as mushrooms, bracket fungi, etc., are placed in boxes with naphthalene flake for several weeks or longer, according to the season, before distributing them in the herbarium. Groups peculiarly liable to attack are examined once or twice a year and fresh naphthalene added when necessary. After a box collection has been once cleared of pests, it is not so difficult to keep them out, with a fair amount of precaution and vigilance.

At Kew Gardens, fungus specimens are treated once a year with carbolic acid (or a cheaper substitute) and alcohol. This mixture is easily applied with a brush to the large number of specimens there that are pasted flat on the sheets without packets.

Dr. Magnus, of Berlin University, advocates the carbon bisulfid treatment once a year, in case there is not sufficient time for separate treatment of specimens with corrosive sublimate, which latter he considers superior. Dr. Magnus works almost entirely with rusts and other minute fungi that attack the leaves of plants.

Dr. Patouillard, of Paris, uses corrosive sublimate exclusively for all groups of fungi, simply immersing the specimens in a mixture of sublimate and alcohol. He is of the opinion that this is the only practical method of preserving them. He says that naphthalene is very good at first, but that when it evaporates the insects return. This might not be possible if his specimens were in close-fitting boxes.

Mr. Hennings, of the Berlin Botanical Garden, uses corrosive sublimate also, having no faith in naphthalene.

Abbé Bresadola, of Trient, claims that insects are entirely killed or expelled by naphthalene and that this substance is far superior to carbon bisulfid, chloroform, strychnine, corrosive sublimate, or carbolic acid. He places fresh specimens of woody forms that are infested with insects in a tight box with naphthalene for a day or less, then dries them and keeps them in a drawer for several weeks with naphthalene before removal to the herbarium. Agarics, because of their perishable nature, are dried before treatment. No naphthalene is used in the regular collection and none appears to be necessary, as I did not find a single insect in his entire herbarium, and not one has appeared in the thousand packets of fungi obtained from him for our collection.

Lars Romell, of Stockholm, follows Bresadola in the use of naphthalene and has no use whatever for sublimate, claiming that specimens are worthless unless recognizable. He frequently places infected agarics under a belljar with chloroform on returning from the field, in order to kill the insects before drying the specimens.

The value of this immense collection of fungi can hardly be overestimated. From a purely botanical standpoint, it is highly important that original and representative specimens of all groups of plants be thus preserved for the purposes of reference and comparison ; and, since questions of origin, distribution and variation always enter into studies of classification, it is desirable to have these collections as complete as possible. From the standpoint of applied botany, the vast number of destructive plant diseases caused by fungi relate this subject very intimately with horticulture, agriculture, forestry and allied sciences. The damage done in this country by wheat rust alone amounts to several billions of dollars annually, and there are other fungus diseases almost as destructive. The fact that practically all of the chestnut trees in and about New York city have been killed in the past few years by a fungus not heretofore known cannot fail to impress one with the importance of the fungi in relation to forestry, both as regards the host of destructive forest diseases already known and those that may yet be discovered.

Aside from the use of this collection by systematic botanists, plant pathologists and foresters, there is a large and increasing interest in fungi by the plant-loving public, drawn by fondness for the queer and unknown, or attracted by bright colors and peculiar forms, or by their extensive use as food. To all these, the collection affords the keenest pleasure and offers opportunities for further knowledge and enjoyment.

This collection is to be the basis of nine volumes of the North American Flora. As the various groups of fungi are worked over and new species published, the number of type specimens in the herbarium will be greatly increased. Students, collectors and investigators of fungi throughout the country will continue to send in specimens for determination and comparison, and will come here in greater numbers to consult not only the originals, but the array of additional specimens that show the variation and the geographical distribution of given species and groups of species.

As material accumulates, without doing violence to the integrity of the collection, duplicates will be sent out in exchange for material from new regions, and to various botanical institutions for the purpose of stimulating activity along certain lines of collecting.

It is hoped that important contributions may in time be made to questions of geographical distribution on the basis of these various collections from distinct regions. For the purpose of recording the distribution of species conveniently and quickly, the distribution chart found at the end of this number of the JOURNAL has been prepared; copies of which are properly marked and pasted on the inside of the species covers, to show at a glance just where a particular species has been collected.

If one wishes to distinguish plants from different regions in the herbarium, he may use gummed paper markers of different colors on the genus covers, or simply indicate the regions by numbers or letters, as shown in the following table:

I.	North America	Na	White.	VI.	India	In	Orange.
II.	Tropical America	Ta	Red.	VII.	China and Japan	Cj	Yellow.
III.	South America	Sa	Blue.	VIII.	Malaya	Ma	Brown.
IV.	Europe and Siberia	Es	Gray.	IX.	Australia	Au	Pink.
V.	Africa	Af	Black.	X.	Islands	Is	Green.

W. A. MURRILL.

THE BANYAN TREE.

In the northwest corner of house no. 4 of the public conservatories will be found a specimen of this interesting tree, which is so highly esteemed by the Hindus. As the accom-

FIG. 3. A young banyan tree in the conservatories.

panying illustration indicates, this specimen is beginning to show plainly the growth of the large aerial roots which make this tree an object of wonder to travelers ; but it can, of course, but faintly suggest its magnificent appearance in its native home along the lower reaches of the Himalayas and the Dekhan peninsula. There are many other trees which attain the height of the banyan tree, but the latter is remarkable for the great spread of its branches, which extend horizontally and send down roots which eventually reach the ground ; and many of these, increasing greatly in diameter, form subsidiary trunks, so that the final effect is more that of a small grove than of a single tree.

The size to which this tree grows in its native wilds is not definitely known, but there are many trustworthy records of its great size in a state of cultivation. There was a specimen growing at Satara in 1882, said to have an average diameter of five hundred and twenty feet in the spread of its branches, and a girth of over fifteen hundred feet. This mere statement, perhaps, does not convey an adequate idea of its magnificent proportions ; but think of such a tree as not only entirely filling the house in which the conservatory specimen is located, but of covering an area with a diameter equal to the entire length of the conservatory range ! One has perhaps heard the statement that a banyan tree could shelter under its branches an army of twenty thousand men ; the tree at Satara would furnish shelter for over fifty thousand men, allowing four square feet for each man.

Another remarkable specimen, somewhat smaller than the one at Satara, is in the botanical garden at Calcutta, and is about one hundred and twenty-five years old. It was described some years ago by Dr. King, who gave the girth of the main trunk as forty-two feet, the circumference of the leafy crown as eight hundred and fifty-seven feet, and the number of aerial roots as two hundred and thirty-two. It originated about 1782 from a seed dropped in the crown of a date-palm, presumably by some bird, a common method of dissemination of this and other similar trees. Following its usual custom, it grew vigorously, tightly encompassing the sheltering and supporting palm with its roots, and finally strangling it, taking the place of its foster parent in the vegetable world.

The banyan tree is often a very active agent in the destruction of the walls of temples and other buildings. A seed, deposited by some passing bird in a crevice of some wall, soon germinates, sending its stout roots further and further into the crevice, and finally destroys the structure. One would immediately suggest that such destruction might be avoided by merely uprooting the young plants ; but this tree is held sacred by the Hindus, and, if any damage threatened the young tree, the building, and not the tree, would be sacrificed.

The word "banyan" seems to have been first applied to a large tree of this species which grew at Gombroon. This specimen was a favorite of the "Banyans," or Hindu traders, who had settled at this place and had built a pagoda under its branches.

Economically, the banyan tree is of considerable importance to the people in the regions where it grows. It yields a milky juice, as others of this genus do, and from this an inferior quality of rubber is extracted. It is also made into a bird-lime by mixing with it a certain proportion of mustard-seed oil. A coarse rope and more or less paper are made from its bark. Medicinally, it is used externally to relieve pains and bruises, and it is considered of great value as an application for the soles of the feet when cracked or inflamed. An infusion of the bark is considered of great value as a tonic and in the treatment of diabetes. In times of scarcity the small red figs are eaten by the poorer classes, this large tree being a relative of the fig-tree which furnishes the edible figs of commerce. The leaves and young twigs are eaten with apparent relish by elephants and cattle. The leaves also fill another want, for they are frequently used as plates. The wood is said to be of moderate hardness, but is not of much value; its durability in the presence of moisture, however, makes it useful for well-curbs. The wood of the aerial roots is said to be stronger, and this is often used for tent-poles, cart-yokes, etc.

The genus *Ficus*, of which the banyan tree is but one species, is widely distributed, almost exclusively in tropical regions, in both the old world and the new, being especially abundant in the former. At the present time there are said to be about six hundred known species, of which two are well known to many as the rubber plant, *Ficus elastica*, and the edible fig, *Ficus Carica*. All of them have the peculiar fruit known as a fig, consisting of a modified branch in the shape of a hollow receptacle, on the inside of which are borne the numerous flowers, the pistillate ones developing the small seeds, which are so numerous in the edible fig.

In the immediate vicinity of the banyan tree in house no. 4 will be found a number of other species of the genus *Ficus*, including a large specimen, in the center of the house, of the common rubber plant, *Ficus elastica*.

GEORGE V. NASH.

PREAMBLE AND RESOLUTION ADOPTED BY THE SCIENTIFIC DIRECTORS RELATIVE TO THE DEATH OF PROFESSOR LUCIEN M. UNDERWOOD.

WHEREAS, Death has removed from this Board Professor Lucien Marcus Underwood, our associate from the commencement of our organization, and our chairman since the year 1901,

We therefore desire to record an expression of our profound sorrow at the severance of such happy personal relations as have always existed between the deceased and members of this Board, and at the untimely ending of a career of such present value and of such great promise.

We desire also to place upon record our appreciation of the great value to the New York Botanical Garden of the services rendered by Professor Underwood, both in his official capacity and by virtue of his high and broad scholarship.

As our chairman, Professor Underwood has always performed his duties in a prompt, studious and efficient manner, and has shown rare wisdom in conserving the higher interests of the institution and of those served by it.

As an original investigator in those lines of research which it is the object of the Garden to promote, Professor Underwood has displayed untiring energy, combined with independence and originality, and his work has been fruitful in many important contributions to science.

As an adviser and guide in the investigations of others, here and elsewhere, Professor Underwood has exerted a wide influence, and has displayed unselfish devotion and a generous regard for the interests of those so engaged.

The cheerfulness and general good-fellowship of Professor Underwood in his personal relations with us, and with the members of the Garden Staff, have been such as to combine the most pleasant recollections with the most sorrowful regret that we are to enjoy them no more.

Resolved, that a copy of this memorial be transmitted to the family of Professor Underwood, and that the same be entered upon our minutes and published in the Garden JOURNAL.

(Signed) J. F. KEMP,
Secretary.

December 14, 1907.

NOTES, NEWS AND COMMENT.

At a recent meeting of the board of managers, Dr. W. A. Murrill was advanced from the position of first assistant to that of assistant director.

Dr. M. A. Howe and Percy Wilson returned from the Bahamas January 5, with a large collection of plants, in which both terrestrial and marine species are well represented.

Mr. W. R. Maxon, of the U. S. National Museum, spent several days at the Garden early in January examining the fern collections.

Dr. N. L. Britton attended the meetings of the American Association for the Advancement of Science and Affiliated Societies at Chicago during the holidays.

Mr. H. S. Jackson, of the State Experiment Station, Newark, Delaware, spent the latter part of December at the Garden studying the fungus collections from Delaware.

Professor J. C. Arthur and Mr. F. D. Kern, of Purdue University, were awarded research scholarships for the month of January, to aid them in their investigations of the North American species of rusts (Uredinales), a group of parasitic fungi very destructive to cultivated plants.

The orchids are at their best during January and February. The large additions of rare and attractive species during the past year make the collection one of great interest and beauty.

Some Recent Visitors. — Professor W. L. Bray, of Syracuse University; Professor A. W. Evans, of Yale University; Dr. C. F. Millspaugh, of the Field Museum of Natural History, Chicago; Professor A. H. Graves, of the Yale Forestry School; Professor John F. Cowell, Director of the Buffalo Botanic Garden; and Mr. Stewardson Brown, of the Academy of Natural Sciences, Philadelphia.

Meteorology for December. — The total precipitation for the month was 4.42 + inches. Maximum temperatures were recorded of 57° on the 8th, 58° on the 10th, 55° on the 23d, and 53° on the 28th; also minimum temperatures of 18° on the 5th, 23° on the 13th, 22° on the 20th, and 26.5° on the 25th and 27th.

The maximum temperature recorded for the year was 93°, occurring on July 8, 18, and 25; the minimum temperature for the year was — 2°, on February 6; the mean temperature for the year, therefore, was 45.5°. The total precipitation recorded for the year 1907 was 47.01 + inches. The first fall frosts occurred during the first week in October.

ACCESSIONS.

LIBRARY ACCESSIONS FROM NOVEMBER 1 TO DECEMBER 31, 1907.

Arthur, Joseph Charles & MacDougal, Daniel Trembly. *Living plants and their properties.* New York, 1898. (Deposited by the Trustees of Columbia University.)

Britton, Nathaniel Lord. *Manual of the Flora of the Northern States and Canada.* Ed. 2 [second impression]. New York, 1907. (Given by the author.)

Elgood, George S. *Italian gardens.* London, 1907.

Heidenhain, Martin. *Plasma und Zelle.* Erste Abteilung: Allgemeine Anatomie der lebendigen Masse. Lief. 1. Jena, 1907.

Lakowitz, Conrad. *Die Algenflora der Danziger Bucht.* Danzig, 1907.

Loudon, John Claudius. *An encyclopaedia of agriculture.* Ed. 4. London, 1839. (Given by the Trustees of Columbia University.)

MATSUMURA, JINZO. *Index plantarum japonicarum.* Tokioni, 1904–05. 2 vols.

MATSUMURA, JINZO & HAYATA, BUNZO. *Enumeratio plantarum in insula Formosa sponte crescentium.* Tokyo, 1906. (Given by Dr. C. B. Robinson.)

MAURY, MATTHEW FONTAINE & FONTAINE, WILLIAM MORRIS. *Resources of West Virginia.* Wheeling, 1876. (Given by Dr. J. H. Barnhart.)

MILLER, PHILIP. *Gardener's dictionary.* London, 1731.

NEGER, FRANZ WILHELM. *Die Nadelhölzer (Koniferen) und übrigen Gymnospermen.* Leipzig, 1907. (Deposited by the Trustees of Columbia University.)

[NIEDERLEIN, GUSTAVO, *and others.*] *Official handbook. Description of the Philippines.* Part 1. Manila, 1903. (Given by Dr. J. H. Barnhart.)

Proceedings of the Society for Experimental Biology and Medicine. Vols. 1–4. 1904–7. (Given by Dr. William J. Gies.)

STEVENS, WILLIAM CHASE. *Plant anatomy . . . and handbook of micro-technic.* Philadelphia, 1907.

WATT, GEORGE. *The wild and cultivated cotton plants of the World.* London, 1907.

WIESNER, JULIUS. *Der Lichtgenuss der Pflanzen.* Leipzig, 1907.

WOOLSON, GRACE A. *Ferns and how to grow them.* New York, 1906.

ZELLNER, JULIUS. *Chemie der höheren Pilze.* Leipzig, 1907.

ZOPF, FRIEDRICH WILHELM. *Die Flechtenstoffe in chemischer, botanischer, pharmakologischer und technischer Beziehung.* Jena, 1907.

PICTURE COLLECTION.

1 photograph of a view in Bronx Park. (Given by Dr. N. L. Britton.)

1 portrait of Professor Charles F. Chandler. (Given by Dr. N. L. Britton.)

5 photographs of botanists. (Given by Mrs. N. L. Britton.)

1 photograph of Porto Rico. (Given by Mrs. N. L. Britton.)

1 photograph of Evening Primroses in Professor de Vries' garden, Amsterdam. (Given by Mrs. N. L. Britton.)

1 photograph of Abbé G. Bresadola. (Given by Dr. W. A. Murrill.)

1 photograph of a portrait of Linnaeus. (Given by Dr. P. A. Rydberg.)

18 plates from various sources.

MUSEUMS AND HERBARIUM.

4 specimens of drugs. (Given by Dr. H. H. Rusby.)

634 specimens of Texas plants. (By exchange with the Missouri Botanical Garden.)

5 specimens of North American ferns. (Given by Professor L. M. Underwood and Dr. Philip Dowell.)

1 fern. (Given by Mr. H. D. House.)

25 wax models of tropical fruits. (Made by Mr. A. Hyatt Verrill.)

2 specimens of fungi from British Columbia. (Given by Mr. E. W. D. Holway.)

68 specimens of flowering plants from Missouri. (Given by Mr. B. F. Bush.)

27 specimens of ferns. (Given by Dr. Philip Dowell.)

485 specimens of Mexican plants. (Collected by Dr. E. Palmer.)

5 specimens of *Viola* from South Carolina. (Given by Mr. H. D. House.)

2 specimens of *Cunninghamites elegans* from North Carolina. (Given by Mr. E. W. Berry.)

3 specimens of flowering plants from Lake Morey, Vermont. (Given by Dr. Arthur Hollick.)

3 specimens of coniferous plants from California. (Given by Mrs. H. L. Britton.)

4 specimens of ferns from Palisades Park, New Jersey. (Given by Mr. F. Pauls.)

32 specimens of North Amer can ferns. (Given by Mr. R. C. Benedict.)

449 specimens of cryptogams from Guadeloupe and Martinique. (Collected by Père Duss.)

5 specimens of fungi from Forked River, New Jersey. (Given by Mr. W. H. Ballou.)

9 specimens of fungi from Missouri. (Given by Dr. N. M. Glatfelter.)

1 specimen of Travertine from the Salton Basin, Arizona. (Given by Dr. D. T. MacDougal.)

4,500 lichens, being the collection of Dr. H. E. Hasse. (Given by Mr. John I. Kane.)

1 specimen of *Monotropa* from Florida. (Given by Mr. H. S. Fawcett.)

80 specimens of polypores from West Virginia. (By exchange with Mr. C. P. Hartley.)

13 specimens of mosses from Georgia and Massachusetts. (Given by Mr. H. H. Bartlett.)

1 specimen of *Plagiothecium Muellerianum* from Manchester Centre, Connecticut. (Given by Miss Annie Lorenz.)

1 specimen of *Yara Cardamonis*. (Given by Parke, Davis and Company.)

4 specimens of drugs. (Given by Dr. H. H. Rusby.)

1 specimen of the fruit of *Passiflora incarnata*. (Given by Dr. W. A. Murrill.)

3 specimens of North American food plants. (Given by Dr. H. H. Rusby.)

1 specimen of *Callistemon lanceolatus* from Florida. (Given by Professor P. H. Rolfs.)

4 specimens of fruits of North American trees. (Given by Dr. J. A. Shafer.)

125 specimens of flowering plants from Guatemala. (Collected by Mr. H. von Turckheim.)

6 specimens of twigs of North American trees. (Given by Dr. J. A. Shafer.)

270 specimens of California plants. (Collected by Mr. A. A. Heller.)

PLANTS AND SEEDS.

5 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

44 plants for nursery. (Given by Mr. W. W. Eggleston.)

1 plant for conservatories. (By exchange with Mr. F. Weinberg.)

5 packets of seed. (Given by Dr. H. H. Rusby.)

JOURNAL

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THE HERBARIUM OF THE LATE DR. OTTO KUNTZE.

Dr. Otto Kuntze, a distinguished German botanist who died at San Remo, Italy, on January 28, 1907, accumulated during his busy life a large and important herbarium which was offered for sale. Through the generosity of Mr. Andrew Carnegie, vice-president of the board of managers, this valuable collection of prepared specimens of plants has been acquired by the New York Botanical Garden. It comprises 403 boxes about 8 inches long, 12 inches wide, and 6 inches deep, of dried specimens attached to sheets of paper, thoroughly poisoned to prevent insect depredation and carefully labeled by Dr. Kuntze. A rough estimate indicates that there are over 30,000 specimens.

This herbarium contains plants from all parts of the world, and includes specimens of many species not heretofore represented in the collections of the Garden. Dr. Kuntze travelled widely and collected and observed plants in many countries. During the years 1874–1876 he made a trip around the world, proceeding from Bremen to the West Indies and collecting on the islands of St. Thomas, Porto Rico, and Barbados; thence to Trinidad, Venezuela, and Colombia; thence to Panama and Costa Rica, returning to Panama; he reached New York in July, 1874, and proceeded westward, collecting in New Jersey, New York, Ohio, Illinois, Missouri, Kansas, Nebraska, Colorado, Wyoming, Idaho, Nevada and California; he reached Japan in December of that year, and in January proceeded to China where he collected about Hongkong and Canton, in Anam, Cochin China and Siam, proceeding to Java, Singapore, Penang, Birma, thence to India, where he explored about Calcutta, going north into Sikkim, returning to Bengal and Bombay; the early part of the year 1876 he spent in Arabia and Egypt.

He visited eastern Asia and Russia in the year 1886, and the Canary Islands in 1887–1888.

In December, 1891, he proceeded to South America, reaching Montevideo in December and remaining in Uruguay, and in the Argentine Republic through part of January, 1892. He crossed the Andes into Chili, collecting at several localities, including the Desert of Atacama, proceeded to Bolivia, where he visited regions botanically very little known, and remained in that country through the summer, reaching Paraguay in September and proceeding to Brazil at the end of the year, reaching Pernambuco December 27, 1892.

In January, 1894, he explored in South Africa, landing at the Cape of Good Hope and collecting in Cape Colony, the Orange Free State, the Transvaal and Natal, reaching Durban in March and proceeding northward by sea to Delagoa Bay, Beira, Mozambique, Dar-es-Salam and Zanzibar, returning to Europe by the Suez Canal.

His last extensive trip was made in 1904, when he reached Ceylon in February, proceeded to Australia, Tasmania, New Zealand, Samoa, the Sandwich Islands, and returned to Europe by way of the United States.

He studied his extensive collections principally at the Royal Botanical Garden in Berlin and at the Royal Gardens at Kew, England, where the writer had the pleasure of meeting him for the first time in 1888. The scientific results of these expeditions are mostly presented by him in the three volumes entitled "Revisio Generum Plantarum, cum Enumeratione Plantarum Exoticarum in Itinere Mundi Collectarum," published from 1891 to 1898; in these he gives a list of plants collected, with many critical notes, records of geographic distribution, descriptions of species new to science, and discussions of nomenclature, this subject being one to which he paid enthusiastic attention and through which he will probably be best known in the future. A considerable part of his collections was referred to other experts for critical study.

To American botanists the greatest interest of his herbarium is in the large number of type specimens which it contains of species from South America and Tropical America described either by himself or other botanists; he collected few duplicates, his rapid movements from place to place during his travels requiring that he should reduce his luggage to as small an amount as practicable, and in a large number of cases the specimens obtained for the Garden by the generosity of Mr. Carnegie are thus unique, not being represented at any other institution.

N. L. BRITTON.

THE COLLECTIONS OF MOSSES AND HEPATICS.

The moss collections at the Garden are arranged in two series, like those of the fungi, one in the museum of systematic botany on the second floor of the museum building and the other in the moss room and in the cryptogamic laboratory on the top floor. The former is for the benefit of teachers and the general public, the latter for the use of students only.

The public museum collection consists of about 599 specimens and illustrations and is installed in 8 cases and 12 swinging frames. The structure of *Funaria hygrometrica*, *Mnium cuspidatum*, *Polytrichum commune*, and two species of *Frullania* are also illustrated by microscopic exhibits. Specimens are mounted on blocks or cardboard or preserved in formalin. Illustrations have been obtained for most of the species exhibited, and specimens in bulk have been secured to show their habit of growth and general appearance.

The swinging frames are designed to illustrate the local flora, or all species known to grow within a radius of 100 miles from New York City, and to give the range of each species and its common name: 468 species are included in this series, 384 of these being mosses and 84 hepatics.

The study collection of these plants may be found on the top floor, the mosses in the cryptogamic laboratory, under Mrs.

Britton's care, and the hepatics with the algae, under Dr. Howe's care. The acquisition of the Mitten Herbarium of mosses and hepatics, an account of which was published in the JOURNAL for February, 1907, has made necessary a great deal of mounting, as all his specimens were laid loosely in folders or pinned to sheets and these are gradually being incorporated with collections already at the Garden. The American species, including those from South America, Central America and the West Indies are being mounted first, and these have made possible many comparisons and exchanges which throw light on our knowledge before the publication of the volume on mosses of "North American Flora." It is increasingly evident that there has been much duplication of naming by various European authors and we acknowledge our obligations to Professor Max Fleischer and Dr. Urban of the Royal Botanical Garden and Museum at Berlin for numerous comparisons with the originals of American species named by S. E. Bridel and Karl Müller. We are also under lasting obligations to Mr. C. H. Wright at Kew Gardens and Mr. Anthony Gepp at the British Museum of Natural History at South Kensington for comparisons with valuable collections preserved at these two institutions. It is expected that some adequate acknowledgment will be made when we come to distribute the duplicates from the Mitten Herbarium and the large number which have accumulated as a residue from our West Indian collections. We are also indebted to Messieurs Renauld and Cardot for portions of types or authentic specimens of many of their Central American and North American species and have arranged for an exchange of notes and specimens with Mr. V. F. Brotherus, who is enumerating the mosses of the world for Engler and Prantl's Natürlichen Pflanzenfamilien.

An effort has been made to follow critically all the species listed from North America and a card catalogue has been kept for this purpose, to which are added corrections in synonymy and extensions of range. These cards now record 148 acrocarpous genera with 1,642 species and 98 pleurocarpous genera with 491 species, and the enumeration is not yet completed.

From Mr. William R. Maxon, of the National Museum, we have received duplicates for determination of all his West Indian and Central American collections, and Dr. George N. Best has continued to examine and report on all the Leskeaceae sub mitted to him for study.

Mr. R. S. Williams has devoted much time to studying the collections made by him in Bolivia and has extended his studies northward along the Andes into Central America and Mexico; extensive collections by C. G. Pringle and Jared G. Smith in Mexico, Percy Wilson in Honduras and W. R. Maxon in Costa Rica having been submitted to him for determination.

Before the death of Professor Underwood his collections of hepatics had been purchased for the Garden and these with the Mitten specimens and the Austin Herbarium have been arranged so that they are available to students of these groups in the room where Dr. Howe can give them personal supervision. Miss C. C. Haynes has availed herself of this privilege and for several years has devoted her time during the winter to naming miscellaneous collections from various parts of the United States in connection with her work as Hepatic Curator of the Sullivant Moss Chapter.

Occasional visits are made by Dr. Evans, of Yale University, who is engaged in a critical study of the Hepaticae, and he has with great patience and care named all the collections of hepatics thus far made by the various explorers sent out by the Garden. He is planning to devote several months to the arrangement of the Mitten collections of hepatics, in exchange for which he will have the privilege of selecting duplicates for the herbarium of Yale University.

ELIZABETH G. BRITTON.

THE SPREAD OF THE CHESTNUT DISEASE.*

The disease of our native chestnut, discovered in Bronx Park in 1905 and described in the JOURNAL for June and for Septem-

* Murrill, W. A. A serious chestnut disease. Jour. N. Y. Bot. Garden 7: 143–153. *f. 13–19.* June, 1906.

Merkel, H. W. A deadly fungus on the American chestnut. Ann. Rept. N. Y. Zoöl. Society 10: 97–103. 1906. (Illust.)

Murrill, W. A. Further remarks on a serious chestnut disease. Jour. N. Y. Bot. Garden 7: 203–211. *f. 25–30.* September, 1906.

Murrill, W. A. A new chestnut disease. Torreya 6: 186–189. *f. 2.* September, 1906.

ber, 1906, has continued its ravages among the chestnut trees in and about New York City with unabated virulence. Preventive measures have apparently not affected it in the slightest degree. The pruning of diseased branches has entirely failed to check it,

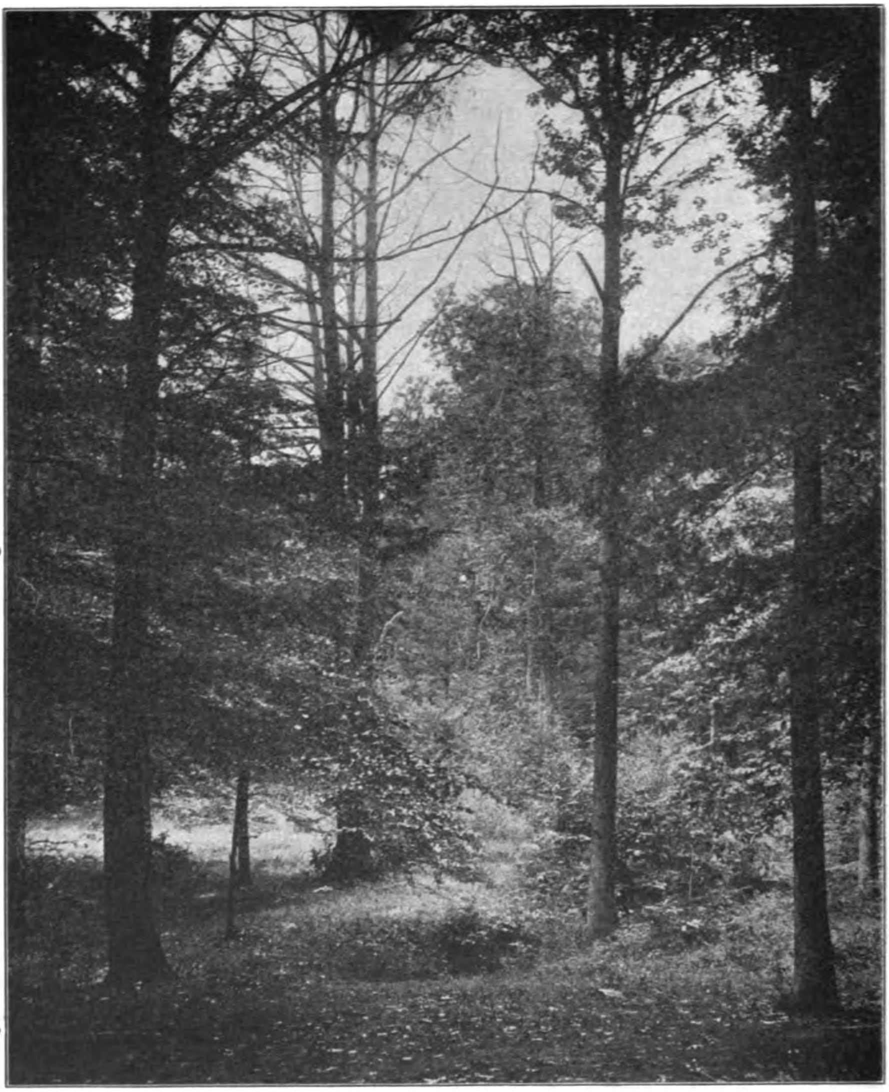

FIG. 4. Chestnut trees in the New York Botanical Garden killed by the disease.

even in the case of very young trees. Branches have been carefully removed and wounds covered, leaving trees apparently

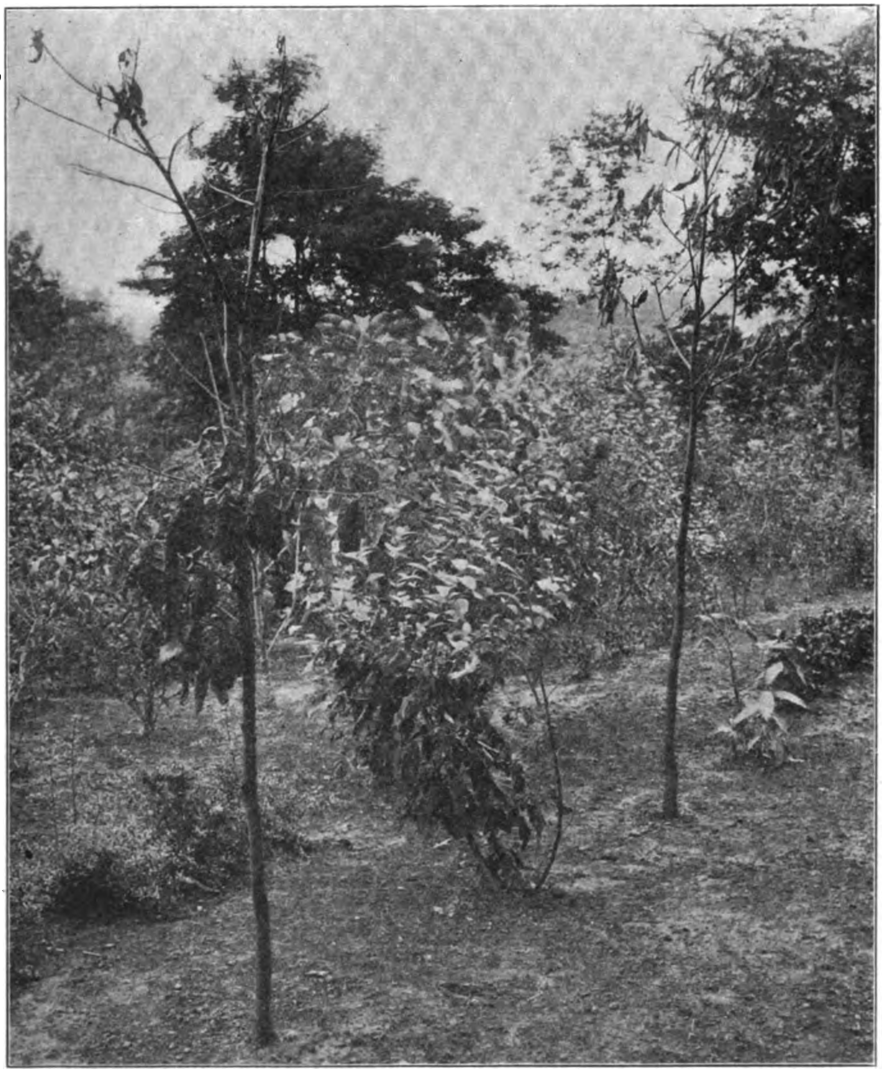

FIG. 5. Affected chestnut trees in the nursery.

entirely sound, but upon inspection a few weeks or a few months later they would be found badly diseased at other points. From ten to fifteen different infections were counted on single specimens of young trees near the hemlock forest during the past season. When the infections are as numerous as this no means of prevention is worth the experiment; and, moreover, some of them are practically certain to be infections of the main trunk, which cannot

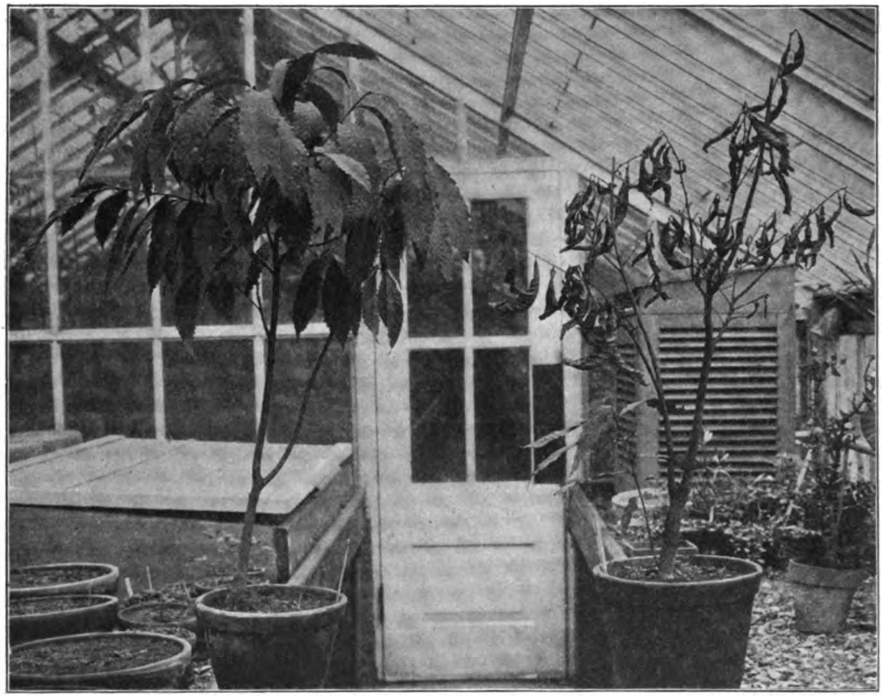

FIG. 6. Inoculation experiments with young chestnut trees. Specimen on the right killed to the base of the trunk by a body infection; specimen on the left reserved as a check.

be treated by pruning. This is especially apt to occur because the spores that are washed down from diseased branches find lodgment at the base of the branch where the bark is rough and very often cracked.

The disease is abundant in and about New York City, on Long Island, and in New Jersey, and is known to occur along the Hudson as far north as Poughkeepsie. Specimens have been sent in from Connecticut, Massachusetts and Maryland. It is reported from Washington, D. C., and from Virginia, but I have seen no specimens of it from these localities. Some have thought that the death of numbers of chestnut trees in the lowlands of Georgia and Alabama, as reported some years ago by Mohr and Small, was due to this disease, but no field studies have been made as yet to determine this point. A visit to Biltmore, N. C., however, where dead and dying chestnut trees are exceedingly abundant, failed to discover a trace of the fungus ; death apparently being due to poor soil, forest fires, the chestnut beetle, and the disturbance of natural forest conditions in various ways.

The disease was at first supposed to be confined to our native chestnut, but in the autumn of 1906 an affected branch was found upon one of the Japanese chestnut trees (*Castanea crenata*) growing in the open near the eastern boundary of the Garden. The branch was at once cut away some distance below the affected area and no other infections were noticed on the tree during the remainder of that season. During the spring and summer of 1907, also, the tree appeared healthy and it was thought that the disease had been effectually eradicated by timely pruning; but a closer examination last autumn revealed a large diseased area near the base of the trunk, and the tree will doubtless succumb soon after the next season opens.

This discovery is especially timely because of the fact that the Japanese chestnut has been under observation elsewhere in the vicinity of affected native trees and has been considered immune, so that it has been mentioned as a desirable substitute for the native tree in some of our parks.

Two specimens of chinquapin (*Castanea pumila*) recently examined in the Garden fruticetum have also been found to be badly attacked, and the indications are that they have been suffering from the disease for the past two or three years. It was reported several months ago that the cultivated chinquapins on Long Island were badly affected, but I have seen no specimens.

It is now certain that the chestnut disease attacks all species of *Castanea*, both native and cultivated, that occur in this region, namely, *Castanea dentata*, the common native chestnut, *Castanea crenata*, the Japanese chestnut, and *Castanea pumila*, the cninquapin, found native from New Jersey to Florida.

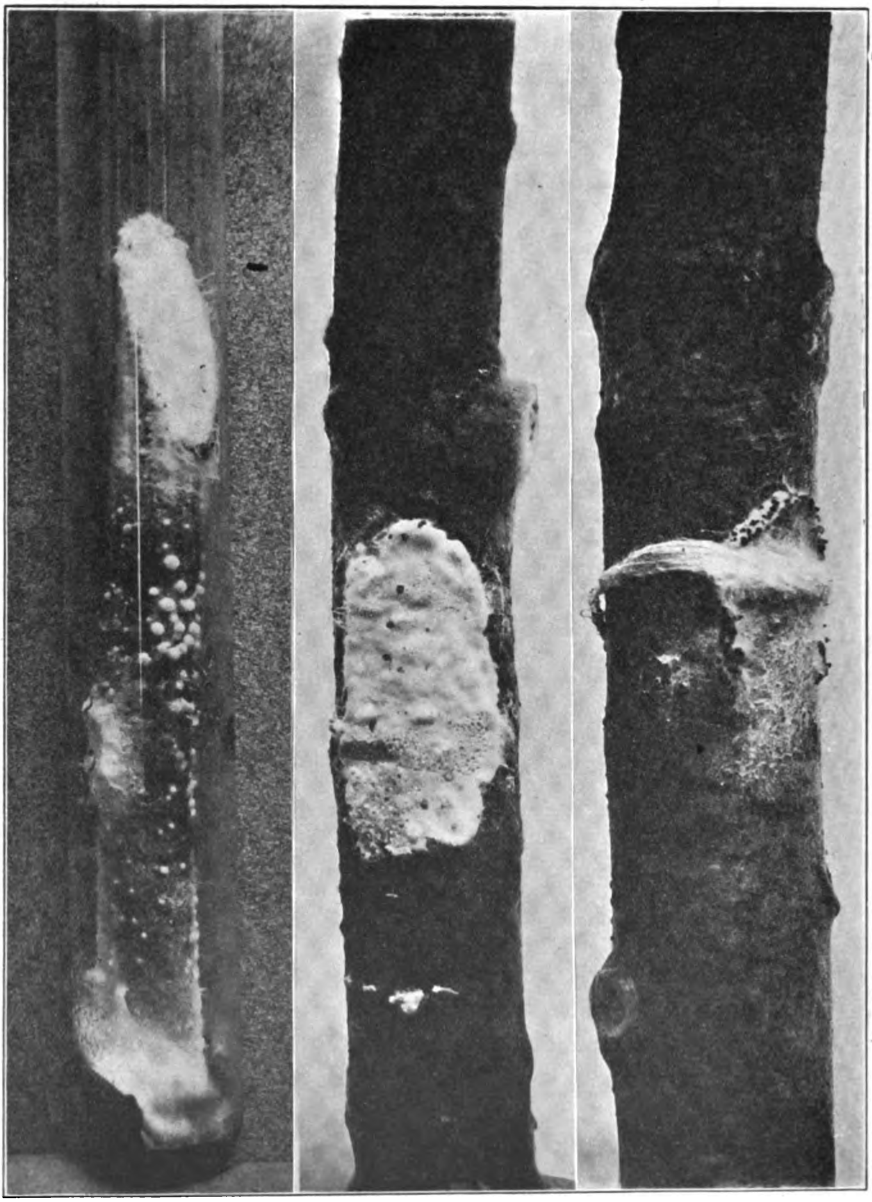

FIG. 7. Cultures of the fungus on sterilized and living chestnut branches.

It is highly important that some effort be made in the near future to determine as accurately as possible the distribution of the chestnut disease and to prevent its spread. Care should also

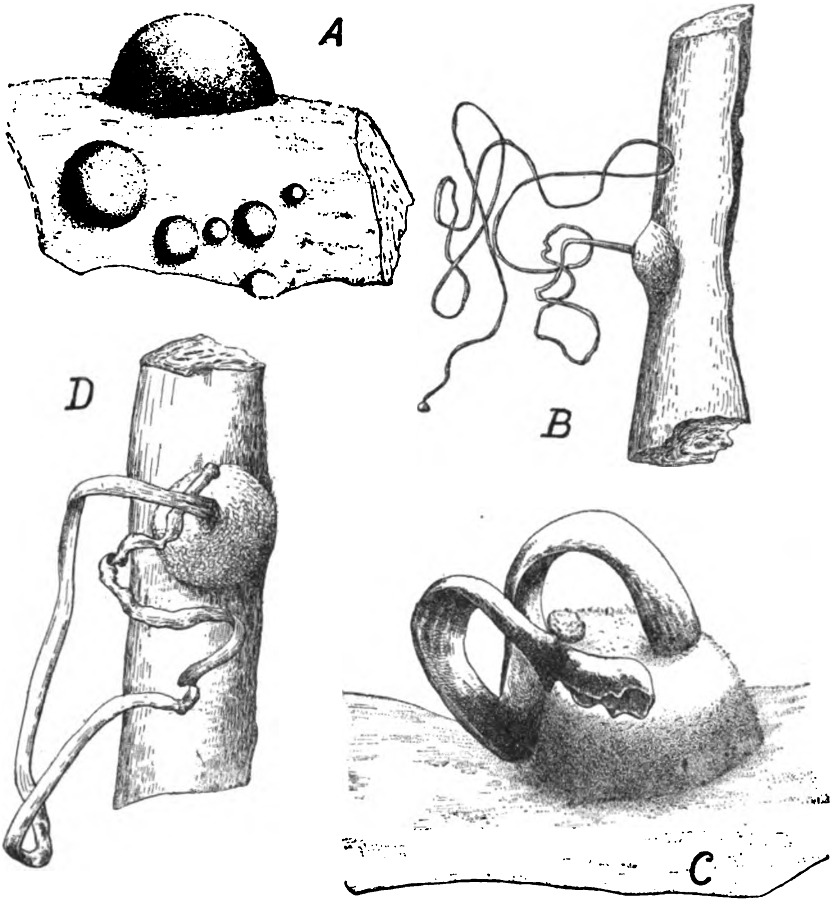

FIG. 8. Fruiting pustules and spore masses of the fungus from cultures, $\times$ 16. *A*, stages in the development of the pustules; *B*, *C*, *D*, various forms of spore discharge in a moist atmosphere.

be taken to prevent its introduction into new localities through diseased nursery stock. The chestnut growers of southern Europe should be warned against the importation of any species of *Castanea* from this country for public or private parks or plantations without inspection by a competent person. The European chestnut is so closely related to our native tree that the fungus would doubtless attack it with equal violence, causing great loss and distress where it is cultivated.

Owners of standing chestnut timber within the affected area are advised to cut and use all trees, both old and young, that stand within half a mile of diseased trees, unless protected from infection through wind-blown spores by dense forest growth or some other natural barrier. This may not prevent the spread of the disease through the agency of storms, birds and squirrels, but it will at least retard its progress. Old weathered chestnut trunks that have been dead several years have no power to spread the disease, and these may be cut at leisure for the tannic acid factory or for firewood. Trees of good size recently killed should be turned into lumber as soon as possible; the fungus affects only the bark, but other fungi may afterwards impair the value of the wood if allowed to stand too long. Discarded branches and young trees of no value that are cut near the edge of the infected area should be burned at once in order to destroy the spores they contain; but if they are well within the zone of infection such precaution is useless.

It is not considered safe at present to put out chestnut plantations at any point within the known area of distribution of the fungus, and those made elsewhere should be started from the seed and carefully guarded. W. A. MURRILL.

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Arthur, J. C. New genera of *Uredinales*. Jour. Myc. **13**: 28–32. 1 Ja 1907.

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——— *Aecidiaceae* (pars). N. Am. Fl. **7**: 129–160. 6 Mr 1907.

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NOTES, NEWS AND COMMENT.

Mr. R. S. Williams, assistant curator, sailed for Colon on January 25, expecting to devote several months to botanical explorations in the Republic of Panama, a region very imperfectly known botanically.

Dr. C. B. Robinson, assistant curator since July 1, 1906, left New York January 21, for the Philippine Islands. His appointment as economic botanist of the Bureau of Science, Manila, was noted in the Journal for November.

Mr. F. V. Coville, botanist in charge of the economic collections, Bureau of Plant Industry, United States Department of Agriculture, spent several days at the Garden early in February examining the herbarium.

Mr. Norman Taylor, who has been a Garden aid for several years, was recently appointed custodian of the plantations.

Mr. W. W. Eggleston has been assigned a research scholarship for two months to aid him in continuing his work upon North American Thorns, genus *Crataegus*.

Mr. George E. Davenport, an enthusiastic and well known student of North American ferns, died at Medford, Massachusetts, November 29, 1907, at the advanced age of seventy-four. Many specimens collected by him are preserved in the Underwood Fern Herbarium of the Garden.

Volume 9, part 1, of the North American Flora, appeared December 19, 1907. Volume 9, part 2, is expected to appear this month. These two parts contain descriptions of all known native species of the Polyporaceae (a large group of woody fungi), except some of the lower resupinate forms, which will be treated at the close of volume 8.

Meteorology for January.—The total precipitation recorded for January was 2.48 inches. Snow flurries occurred on the 9th, snow turning to rain on the 16th, and 10 inches of snow on the 23d and 24th. Thunder and lightning were recorded on the 12th.

Maximum temperatures were recorded of 51° between the 6th and 13th, 53° on the 13th, 60° on the 21st, and 44° on the 27th, also minimum temperatures of 13° on the 6th, 17° between the 6th and 13th, 18° on the 17th, 12° on the 25th, and 1° on the 31st. The thermograph failed to record between the 6th and 13th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

248 specimens of marine algae from Barbados, West Indies. (Collected by Miss Anna Vickers.)

6 specimens of ferns. (Given by Dr. C. B. Robinson.)

8 specimens of mosses from Texas. (Given by Professor S. W. Stanfield.)

13 specimens of mosses from Cuba. (By exchange with the United States National Museum.)

69 specimens of marine algae from North Carolina. (Given by Mr. W. D. Hoyt.)

4,125 specimens of marine algae from the Bahamas. (Collected by Dr. M. A. Howe.)

4 specimens of flowering plants from Georgia. (Given by Mr. M. H. Hopkins.)

6 specimens of mosses from New Hampshire. (Collected by Mr. Percy Wilson.)

24 specimens of mosses from Colombia. (By exchange with the United States National Museum.)

3,418 specimens of flowering plants from the Bahamas. (Collected by Mr. Percy Wilson.)

7 specimens of mosses, hepatics and lichens from the Bahamas. (By exchange with the Field Museum of Natural History.)

38 specimens of flowering plants from Louisiana. (Given by Professor R. S. Cocks.)

1 specimen of rust from British Columbia. (Given by Mr. E. W. D. Holway.)

16 specimens of rusts from western localities. (Given by Mr. Frank D. Kern.)

5 museum specimens of fungi from Forked River, New Jersey. (Given by Mr. W. H. Ballou.)

1 specimen of *Fomes geotropus* from Tennessee. (Given by Mr. Perley Spaulding.)

1 specimen of fungus on a moss from North Carolina. (Given by Dr. A. J. Grout.)

1 specimen of *Fomes* from Pennsylvania. (By exchange with Professor D. R. Sumstine.)

1 specimen of *Clitocybe amethystina* from Indiana. (Given by Professor J. C. Arthur.)

12 specimens of polypores from the Bahamas. (Collected by Mr. Percy Wilson.)

200 specimens, "Fungi Columbiani," Centuries XXV. and XXVI. (Distributed by Mr. E. Bartholomew.)

PLANTS AND SEEDS.

3 plants for conservatories. (Collected in Jamaica by Dr. N. L. Britton.)

4 plants for conservatories. (Given by Dr. D. T. MacDougal.)

1 plant for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

3 plants for conservatories. (By exchange with Bureau of Plant Industry.)

1 plant for conservatories. (Given by Mr. L. M. Simonson.)

1 plant for conservatories. (By exchange with Hope Gardens, Jamaica.)

6 plants for conservatories. (Given by Mr. Hoffmann.)

3 plants for conservatories. (Given by Mr. Sacket.)

1 bulb for conservatories. (Given by Dr. H. H. Rusby.)

1 bulb for conservatories. (Given by Mr. H. C. Pearson.)

1 packet of seed. (Collected by Dr. N. L. Britton.)

4 packets of seeds. (Given by Dr. H. H. Rusby.)

1 packet of seed. (By exchange with Hope Gardens, Jamaica.)

1 packet of seed. (Given by Mr. J. Borin.)

2 packets of seed. (Collected by Dr. J. A. Shafer.)

1 packet of seed. (Given by Dr. O. Beccari, Florence, Italy.)

59 plants derived from seed from various sources.

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REPORT ON THE BOTANICAL EXPLORATION OF THE BAHAMA AND CAICOS ISLANDS.

Dr. N. L. Britton, Director-in-Chief.

Sir: We beg to present herewith a brief report on our recent expedition to the eastern and southeastern islands of the Bahamian archipelago and to the Caicos Islands, which are really a part of the Bahamas geographically, though now for more than half a century associated politically with the Jamaican government. The main object of the visit was to secure herbarium and museum specimens, illustrating both the land and marine flora, for the New York Botanical Garden and the Field Museum of Natural History of Chicago, the latter institution having shared the expense of this and several previous expeditions to the Bahamas. In fact, the present expedition was the seventh that has been sent to the Bahamas since the winter of 1904, either by the New York Botanical Garden alone or by the Garden in coöperation with the Field Museum, and, in addition, much collecting for these two institutions has been done on various islands of the group by Mr. L. J. K. Brace, a botanist resident in Nassau. On this, as on previous visits, considerable attention was given to securing living plants of scientific and economic interest for the conservatories of the Garden.

We left New York on the Ward Line steamer "City of Washington" on Friday, November 15, 1907, and reached Nassau, New Providence, on the morning of the nineteenth. Accompanied by Mr. Lewis Brace of Nassau, we sailed eastward the following afternoon on Mr. William J. Pinder's schooner, the "Nellie Leonora," which had been chartered for us previously to our arrival. Owing to a strong head-wind and heavy seas, we put in at the Bight, Cat Island, on the afternoon of November 22. Little time was given to collecting the commoner land-

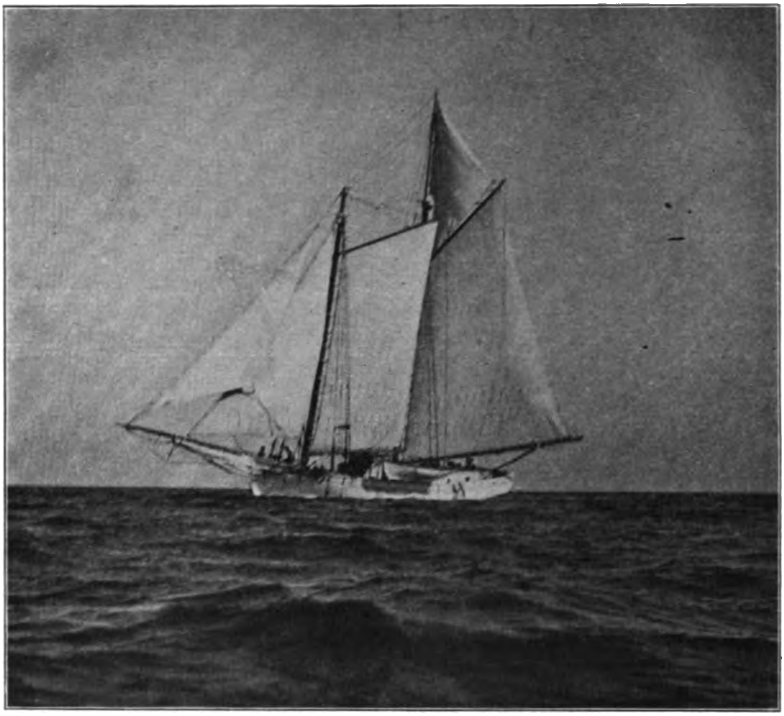

FIG. 9. The "Nellie Leonora" at Rose Island.

plants of this locality as extensive collections were made at this point earlier in the year by yourself and Dr. Millspaugh. A "creek" in this vicinity furnished a number of marine algæ of interest. Leaving the Bight at about noon on the twenty-third, we anchored at sunset near the Southwest Point of this island, where we remained for a few hours during a squall, sailing in the night for Cockburn Town ("Riding Rock"), Watling's Island, where we arrived on the twenty-fifth. Cockburn Town is the port of entry of Watling's Island, and we carried letters of introduction to Mr. Rigby, the Assistant Resident Justice there, to whom we are indebted for various courtesies. Watling's Island is about twelve miles long and six miles wide and a considerable part of its area is occupied by salt-water lakes or lagoons which have no obvious connection with the ocean. The bottoms of these shallow salt lakes are clothed with enormous quantities of the siphonaceous green algæ, *Batophora Oerstedi* and *Acetabulum crenulatum*. *Chara Hornemanni* is also common. As you and Dr. Millspaugh spent four days last March in this western and northern part of Watling's Island, we did not attempt to collect the land-plants here so thoroughly as we might have done otherwise; nevertheless, specimens were taken rather freely and the results seem to justify the trouble, as certain species were found in better condition for collecting in November than they had been in the previous March. The following day, the twenty-sixth, was spent in the vicinity of Graham's Harbor, near the northeastern extremity of the island, not far from the monument on the eastern shore marking the spot where Christopher Columbus is supposed to have "first set foot upon the soil of the New World." Returning on the evening of the same day to Cockburn Town, we proceeded the next morning to the southeastern end of the island, a part which was not visited by the expedition of last spring. Four days, accordingly, were spent here and extensive collections were made. A plant of special interest here was *Euphorbia vaginulata* Griseb., which was quite common on the sands a short distance back from the coast. This was for many years known only from the Turk Islands, where it was obtained in 1858 by J. A. Hjalmarson, who spent fourteen days there in collecting materials which were used by Grisebach in preparing his "Flora of the British West Indian Islands." The plant is now well represented in our herbarium, having been taken by Mr. Nash and Mr. Taylor on Great Inagua and Little Inagua in 1904 and by them also in the type locality in 1905. It was found by us also at South Caicos and on Castle Island. Growing in the sand back from the shore, this species of *Euphorbia* develops into a shrub with a height of from one to nearly three feet, but occurring, as it sometimes does, on exposed littoral rocks, it becomes dwarfed and more or less prostrate and appressed, as may be seen in the accompanying illustration (Fig. 10). A "creek" near the southeastern extremity of Watling's Island furnished some marine algæ of peculiar interest, including fertile specimens of *Halimeda tridens*, which are of exceedingly rare occurrence, having, in fact, been previously reported only from Porto Rico, where they were obtained by a New York

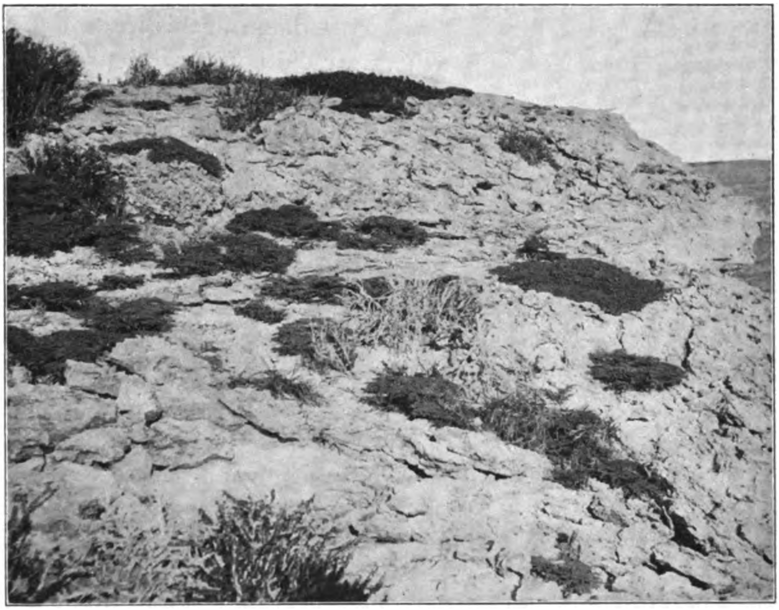

FIG. 10. *Euphorbia vaginulata* Griseb. (the low prostrate-appressed shrub) on white coral sea-cliffs, Long Cay, Cockburn Harbor, South Caicos.

Botanical Garden expedition in 1906. *Halimeda tridens* and *Halimeda Monile*, two closely related and occasionally confused species, were growing in great profusion and in most intimate association in this creek, yet showed no traces of intergrading forms.

From the southern end of Watling's Island, we sailed on the afternoon of November 30 for Atwood (Samana) Cay, a small island about eighty miles to the southeast, anticipating covering this distance by the following daybreak, but the wind shifted and fell during the night and we did not reach the island until the morning of December 3. Atwood Cay is now uninhabited except at certain seasons, when small parties from the neighboring islands visit it in order to gather cascarilla bark, the bark of *Croton Eluteria*. This shrub is still fairly common at certain localities on this island, but in view of the rate at which it is now being uprooted, it seems only a question of a short time when the species will become very scarce. Atwood Cay, we believe, had never been visited by botanists before and the marine flora in particular we found of much interest, including several forms which we think will prove new to science; but up to this time we had suffered considerable delay owing to head winds and calms, so on the morning of December 5, after a stop of only two days, we took advantage of a brisk fair wind and set sail for the island of Mariguana, and the intervening distance of fifty-three miles was compassed in about five hours. We had planned to stop a day or more in the neighborhood of Betsy Bay at the northwest end of the island, where the soil is said to be especially good, but with the wind then prevailing it was not advisable to launch a boat or to anchor at this point, so we skirted the more sheltered south shore until about ten miles west of Abraham Bay, where we dropped anchor. Mariguana is nearly twenty-eight miles long and has a maximum width of six or seven miles. Its highest elevation is given on the charts as 101 feet. This island, like Atwood Cay, had not previously been visited by botanical collectors, so far as our information goes, and we accordingly devoted a week to exploring the southern and western parts of the island. The isolation and scanty population of Mariguana make it an attractive resort for various kinds of birds, of which the most showy and perhaps the most interesting is the red flamingo. A flock of between one hundred and two hundred of these picturesque birds was at the time of our visit dividing its attention between a shallow salt-pond at the eastern end of the island and the almost equally shallow bay or reef-harbor adjacent. Owing to a long-continued drought, many of the plants in this region were in a badly dried-up condition and scarcely suitable for the herbarium, yet nearly seven hundred specimens of flowering plants were secured while we were on this island. In certain rocky areas, the cacti were well represented, and of these one of the most peculiar and striking was the Turk's-head cactus, the plant from which the Turk Islands, about one hundred and twenty miles further southeast, are said to have derived their name. Several living specimens of this cactus were obtained for the conservatories. The photograph (Fig. 11) reproduced herewith illustrates the odd form

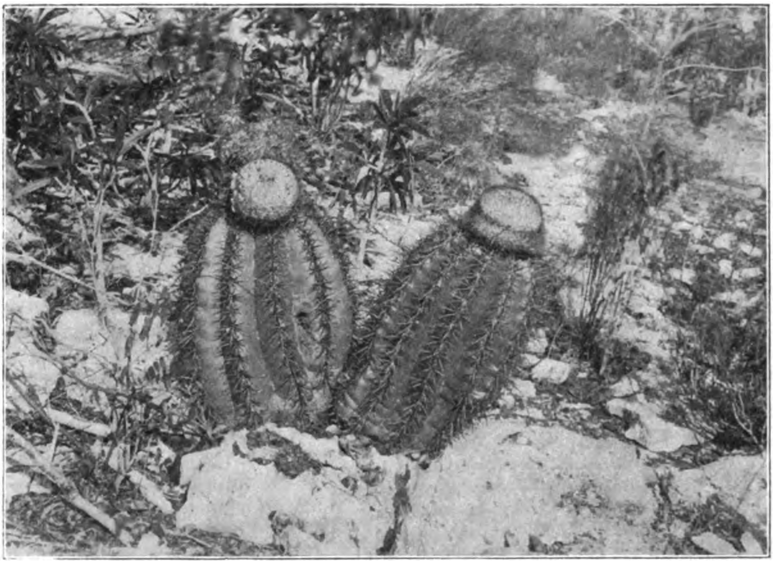

FIG. 11. The "Turk's-head cactus" (*Melocactus* sp.) on the island of Mariguana.

assumed by this plant. The hog-palm (*Pseudophoenix Sargentii*) appeared to be represented at the southeast end of Mariguana by a single specimen, less than six feet high.

On December 12, we sailed from Mariguana for the Caicos Islands, arriving at the port of entry, Cockburn Harbor ("East Harbor"), South Caicos, a little after noon on the fourteenth. South Caicos is only about twenty miles from the island of Grand Turk and it shares with the Turk Islands the fame of producing salt of an excellent quality. It is situated in longitude 71° 30′ and latitude about 21° 30′, and was the most southern and most easterly of the islands visited on this expedition. We remained here from the fourteenth to the night of the sixteenth and collected many interesting plants not found on the other islands, including the Jamaican lignum-vitae, *Guaiacum officinale*, a species which, we believe, has not hitherto been reported from the Bahamas. Cockburn Harbor also furnished us numerous algae of interest.

During our stay at South Caicos, we heard much of the richness of the flora of the neighborhood of the settlement known as Kew, on the island of North Caicos, some forty or fifty miles to the northwest by a direct line, though considerably further by the "outside" or "ocean" route which our schooner was obliged to take in order to reach it. Late in the afternoon of the seventeenth we anchored off Fort George Cay and Pine Cay, at the western end of the island of North Caicos. Pine Cay takes its name from the presence of *Pinus caribaea*, which is fairly common there, though the trees are mostly small, the larger ones having been cut for lumber. It was the first time that we had met with the pine on the present voyage, although the tree is found in considerable abundance on the larger northern and western islands of the Bahamian group, at least on Andros, Great Bahama, Abaco, and New Providence. Arrangements having been made for a visit to Kew, one of our party (Mr. Wilson) started for that point at daybreak of the eighteenth in a small boat, accompanied by two natives and the first mate of the "Nellie Leonora." The distance from our anchorage to Kew Landing was about four miles, and, the route lying over a part of the shallow northern border of the Caicos Bank, a considerable portion of the trip was accomplished by pushing the boat along with a pole. The landing was reached at about ten o'clock and after following a trail for nearly three miles, we sighted the settlement of Kew, where our visit was evidently of as much interest to the inhabitants as the plants found there were to us. The tree locally known as the "oak" (*Bucida Buceras*) here attains a large size, excellent examples of it growing along the main thoroughfare of the village. Owing to the richness of its soil and consequent development of its vegetation, North Caicos was by far the most interesting of the islands visited during the voyage. Some species of woody plants which are shrubs on the other islands here attain the size of trees. A more thorough exploration of this region at some future time would undoubtedly yield results of much scientific value. We were obliged to return to our schooner late in the afternoon of the same day, wading a part of the distance over banks that had been left nearly dry by the ebbing tide.

On the nineteenth a stop of a few hours was made on the the island of Providenciales, in the vicinity of Malcolm Road; good collections of marine algae were made here, but little was accomplished in the way of securing land-plants owing to the dryness of the region. The following day was devoted to exploring the the island of West Caicos. A large portion of this island is under cultivation and its flora, probably for that reason, seemed rather less varied and rich than that of some of the other islands of the Caicos group. There is a large plantation here for the cultivation of sisal (*Agave sisalana*), the property of a London company incorporated under the name of "Pita Ltd." About 1,600 acres are fully planted with sisal, over 1,400 acres are partially laid out and planted, and 700 acres in addition are now being cleared and burned over. An interior salt lake or pond contained several algae of particular interest, one of them being the plant that has commonly been identified with *Valonia aegagropila*, originally described from the lagoons of Venice, where it is said to be very abundant. This *Valonia* was common and luxuriant in this lake on West Caicos, often forming unattached hollow globose masses, sometimes attaining the size of a man's head. While at West Caicos we enjoyed the hospitality of the manager of the estate of the Pita company, Captain Henry T. W. Holdsworth, and his accomplished wife, and we are much indebted to Captain Holdsworth for assistance and helpful suggestions in our investigations of the flora of the island.

A part of December 21 was spent at Little Inagua, which was explored for the Garden by Mr. Nash and Mr. Taylor in 1904, and on the afternoon of the following day, we went ashore for a few hours on Castle Island, near the south end of Acklin's Island, while on our way to the Ragged Islands group, which we reached on the afternoon ot December 23. We remained at Great Ragged Island until the morning of December 27, making good collections there both of the seed-plants and of the algae, including several additions to the known flora of the Bahamian archipelago. A low gray fine-branched shrubby plant of rather striking appearance found there is a member of the morning-glory family, *Evolvulus bahamensis*, recently described as a new species by

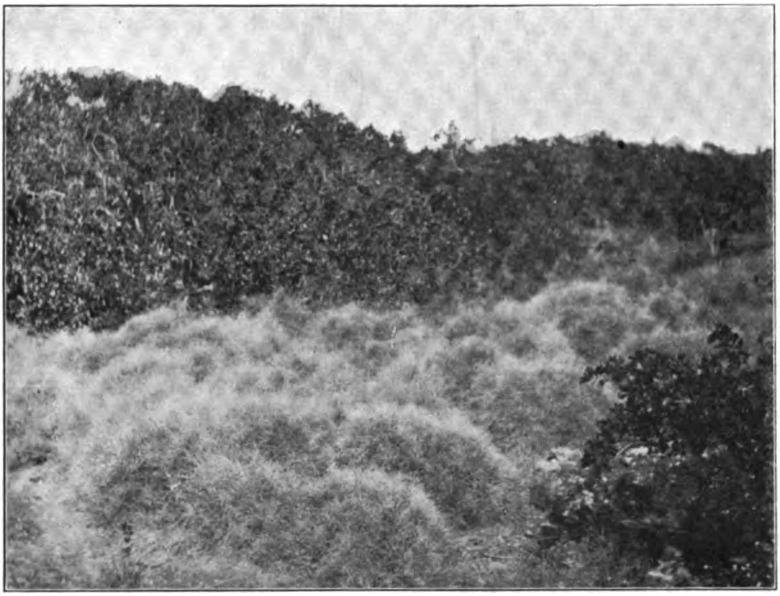

FIG. 12. *Evolvulus bahamensis* House (in foreground), Great Ragged Island.

Mr. Homer D. House. Our photograph (Fig. 12) gives some idea of its habit of growth. During our stay at Great Ragged Island we were the recipients of various helpful favors from the Resident Justice, Mr. Stevenson, to whom we carried a letter of introduction from Hon. Herbert A. Brook, of Nassau, Registrar of the Colony.

From the Ragged Islands we headed northward for the return to Nassau, spending a few hours on the twenty-eighth on Harvey's Cay of the Exuma Chain and the morning of the next day on Rose Island, a few miles northeast of New Providence. Nassau was reached on the afternoon of the twenty-ninth and the following three days were devoted to packing for the voyage to New York, where we arrived on January 5. The algae secured on the expedition are represented by 830 collection-numbers and the seed-plants by 741 numbers, the total doubtless aggregating over 8,000 herbarium specimens. In addition, a considerable amount of museum material was obtained. The living plants collected, representing particularly the Cactaceae, were left in the care of Mr. L. J. K. Brace, of Nassau, to await a more favorable season for shipment to New York.

Respectfully submitted,

MARSHALL A. HOWE,
PERCY WILSON.

SPRING LECTURES, 1908.

Lectures will be delivered in the lecture hall of the museum building of the Garden, Bronx Park, on Saturday afternoons, at 4:00 o'clock as follows:

May 2. "A Botanical Expedition to Jamaica and Cuba," by DR. ARTHUR HOLLICK.

May 9. "Early-Flowering Trees and Shrubs," by DR. N. L. BRITTON.

May 16. "Plant Life of the Sea," by DR. M. A. HOWE.

May 23. "Ornamental Shrubs; Their Selection and Arrangement," by MR. GEORGE V. NASH.

May 30. "Plants that Feed on Insects," by DR. C. STUART GAGER.

June 6. "Adulterants in Foods and Drugs and their Detection," by DR. H. H. RUSBY.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5:28 train from the Botanical Garden Station, arriving at Grand Central Station at 5:57 P. M.

The museum building is reached by the Harlem Division of the New York Central and Hudson River Railway to Botanical Garden Station, by trolley cars to Bedfork Park, or by the Third Avenue Elevated Railway to Botanical Garden, Bronx Park. Visitors coming by the Subway change to the Elevated Railway at 149th Steet and Third Avenue.

NOTES, NEWS AND COMMENT.

Dr. and Mrs. N. L. Britton and Dr. Arthur Hollick sailed for Kingston, Jamaica, on February 22. They have planned to make collections at the western end of the island, and a Bahamian schooner has been chartered for this purpose. It is expected that a stop will be made in eastern Cuba on the return voyage early in April.

Some interesting and very successful experiments with color photography were recently made in the conservatories of the Garden by Mr. F. C. Berte.

Twenty-five sets of duplicate polypores, representing nearly a hundred of our more common species, have recently been sent out by the Garden to certain botanical institutions in the eastern United States and Europe.

Vol. 9, part 2, of the North American Flora, appeared March 12, 1908. This part concludes the treatment of the polypores, and contains most of the large tree-destroying fungi of special interest to foresters.

An attractive Philippine shrub, *Medinilla magnifica*, described and figured in the JOURNAL for July, 1907, is now in flower in the public conservatories, house no. 4.

The seedling of *Tumboa Bainesii*, described in the October number of the JOURNAL, has made considerable growth since that time. By reference to the lower figure there shown it may be seen that the leaves which are eventually to be the permanent ones are considerably shorter than the cotyledons. Now they are at least three eighths of an inch longer than the seed leaves. The only other change of note is the flesh color that has gradually come over the whole plant; but as yet there is nothing that gives one a hint as to the remarkable adult form that it is hoped the plant may some day attain.

Among the cyclamens represented in the conservatories, *Cyclamen Neapolitanum* has a very curious arrangement of its seed pods. After the flower has dropped off, the stalk with the immature fruit begins to spirally contract, so that when the seed is ready to be discharged the pod is tightly held in a closely coiled spiral which is capable of considerable movement when rolled over the ground by the wind or other agencies. A specimen of this plant at the conservatories now presents all stages of this interesting process.

Meteorology for February. — The total precipitation recorded for the month was 5.45 inches, including snow-falls of 7 inches on the 6th, 5 inches on the 19th, and traces of snow on the 16th and 26th. Maximum temperatures were recorded of 46° on the 1st, 44° on the 6th, 51° on the 11th, 40° on the 17th, and 46° on the 27th; also minimum temperatures of 0.5° on the 5th, 11° on the 11th, 13° on the 23d, and 11° on the 25th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM JANUARY 1 TO FEBRUARY 29, 1908.

BROWN, STEWARDSON. *Alpine flora of the Canadian Rocky Mountains.* New York, 1907. (Given by the author.)

COLE, GEORGE WATSON. *Bermuda in periodical literature.* [Boston], 1907. (Given by the author.)

CURTIS, CARLTON CLARENCE. *Nature and development of plants.* New York, 1907. (Deposited by the trustees of Columbia University.)

FITCH, WALTER HOOD, & SMITH, WORTHINGTON GEORGE. *Illustrations of the British flora.* London, 1880. (Given by Mr. F. Weinberg.)

GRISEBACH, AUGUST HEINRICH RUDOLPH. *Flora of the British West Indian Islands.* London, 1859–64. (Given by Dr. Margaret B. Wilson.)

Illinois State Agricultural Society. *Transactions.* Vols. 5, 25. Springfield, 1865, 1889. 2 vols.

Illinois State Horticultural Society. *Transactions.* New ser. Vols. 21–22. Warsaw, 1888–89. 2 vols.

Iowa State Agricultural Society. *Report* for 1863–64, 1868–69, 1874–75. Des Moines, 1864–76. 6 vols.

JORDAN, DAVID STARR. *Fishes.* New York, 1907. (Given by Dr. N. L. Britton.)

Kansas State Board of Agriculture. *Report* for 1875. Topeka, 1875.

LOW, ALBERT PETER. *Report on the Dominion government expedition to Hudson Bay and the arctic islands on board the D. G. S. Neptune 1903–1904.* Ottawa, 1906. (Given by Mr. J. M. Macoun.)

Massachusetts Board of Agriculture. *Synoptical and analytical index, 1837–92.* Boston, 1893.

MIGULA, WALTER. *Kryptogamen-Flora von Deutschland, Deutsch-Österreich und der Schweiz* Band II., Algen. 1 Teil. Gera, R., 1907.

VIDAL Y SOLER, SEBASTIAN. *Phanerogamae Cumingianae philippinarum.* Manila, 1885.

Wisconsin State Agricultural Society. *Transactions.* Vol. 7. Madison, 1868.

Wisconsin State Horticultural Society. *Transactions.* Vol. 12. Madison, 1882.

MUSEUM AND HERBARIUM.

104 specimens of flowering plants from British America. (By exchange with the Geological Survey of Canada.)

2 specimens of flowering plants from Indiana. (Given by Professor J. C. Arthur.)

2 museum specimens of bark and sap of the Cow Tree from Venezuela. (Given by Mr. F. F. von Wilmousky.)

1 specimen of yam root. (Given by Dr. H. H. Rusby.)

6 specimens of drugs and spices. (Given by Dr. H. H. Rusby.)

116 specimens of flowering plants from Nevada. (By exchange with Professor P. B. Kennedy.)

230 museum specimens of marine algae from the Bahamas. (Collected by Dr. M. A. Howe.)

240 specimens of flowering plants from Barbados, West Indies. (Collected by Mr. J. S. Dash.)

6 specimens of violets from South Carolina. (By exchange with Mr. H. D. House.)

6 specimens of ferns from eastern North America. (Given by Miss Margaret Slosson.)

10 specimens of mosses from North Carolina. (Given by Dr. A. J. Grout.)

140 specimens of mosses and hepatics from Guadeloupe. (Collected by Rev. Père Duss.)

2 specimens of mosses from Guatemala. (By exchange with the U. S. National Museum.)

60 specimens "Musci Americae Septentrionalis Exsiccati." (Distributed by Mr. J. Cardot.)

7 specimens of mosses from Georgia. (By exchange with Professor J. F. Collins.)

20 specimens of polypores from Delaware. (By exchange with the Delaware Agricultural Experiment Station.)

2 specimens of *Gloeophyllum* from the eastern United States. (By exchange with the U. S. Department of Agriculture.)

149 specimens of fleshy fungi from Massachusetts. (Given by Mr. Geo. E. Morris.)

1 package of "Koffeno." (Given by the Sleepy Eye Milling Company.)

3 specimens of drugs. (Given by Dr. H. H. Rusby.)

1 specimen of fruits of the Stone Pine. (Given by Dr. H. H. Rusby.)

35 specimens of marine algae from the Danish West Indies. (By exchange with Mr. F. Börgesen.)

PLANTS AND SEEDS.

1 plant for conservatories. (Given by Miss Helen M. Gould.)

2 plants for conservatories. (Purchased.)

5 plants for conservatories. (Given by Mr. C. Wercklé.)

3 plants for conservatories. (By exchange with Department of Parks, Borough of Brooklyn.)

1 plant for conservatories. (Given by Mr. Oakes Ames.)

2 plants from Mexico for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 root for conservatories. (Given by Dr. H. H. Rusby.)

1 packet of seed. (Given by Dr. H. H. Rusby.)

14 packets of seed from Costa Rica. (Given by Mr. C. Wercklé.)

1 packet of seed from Jamaica. (By exchange with Public Gardens, Jamaica.)

33 packets of seed from North Carolina. (Collected by Mr. W. W. Eggleston.)

1 packet of seed from Sonora. (By exchange with the United States National Museum, through Dr. J. N. Rose.)

1 packet of seed from Bronx Park. (Collected by Mr. R. C. Schneider.)

28 plants derived from seed from various sources.

JOURNAL

OF

The New York Botanical Garden

Vol. IX. April, 1908. No. 100.

REGISTERED INVESTIGATORS AT THE NEW YORK BOTANICAL GARDEN, 1897–1908.

Abrams, LeRoy, Stanford Univ, Calif. b. Sheffield, Ia, Oct. 1, 74. Stanford, A.B, 99, A.M, 02; Columbia (fel.) and **N. Y. Bot. Garden, 04–05; research sch, N. Y. Bot. Garden, 05.** Act. prof. bot, Idaho, 99–00; asst. syst. bot, Stanford, 00–02; instr, 02–04; asst. curator, Div. Plts, U. S. Nat. Mus, 05; *asst. prof. bot, Stanford, 06–.* A. A. A. S; Nat. Geog. Soc; Wash. Bot. Soc; Wash. Biol. Soc; Torrey Bot. Club.

Taxonomy.

Anderson, Mary Perle, Horace Mann School, N. Y. C, and East Berkshire, Vt. b. East Berkshire, Vt, June 9, 64. Mt. Holyoke, B.S, 90; Mass. Inst. Tech, 97–98; Woods Hole, 99; Chicago, 02–04; Columbia and ***N. Y. Bot. Garden, 06–08;*** Kew, and Jardin des Plantes (Paris), 07. Tea. sci, K. C. L. College (Independence, Mo.), 90–94; tea. sci, Plymouth (Mass.) H. S, 94–95; instr. biol, Somerville (Mass.) H. S, 95–02; instr. nat. study, Vermont State summer schools, 02, 04, 05; instr. biol. and nat. study, summer session, Columbia, 03; instr. bot, Mt. Holyoke, 04–06; *critic tea, biol. and nat. study, Tea. Coll, Columbia, 07–.* 1st Stokes prize essay, Wild Flower Pres. Soc. Am, 04. Am. Nat. Study Soc.

Geographical distribution of the ferns of Japan.

Arthur, Joseph Charles, Lafayette, Ind. b. Lowville, N. Y, Jan. 11, 50. Iowa State, B.S, 72, M.S, 77; Hopkins, 78–79; Harvard, 79; Cornell, Sc.D, 86; Bonn, 96; **N. Y. Bot. Garden,**

03, 04, research sch, 06, 07, 08. Instr. bot, Minnesota and Wisconsin, 79–82; bot. Exp. Sta, Geneva, N. Y, 84–87; *prof. veg. physiol. and path, Purdue, 87–; bot, Ind. Exp. Sta, 88–;* Int. Cong. Arts and Sci, St. Louis, 04 (speaker); Internat. Bot. Cong, Vienna, 05 (del. Smith. Inst.). Fel. A. A. A. S (sec'y, Sec. F, 86; asst. gen sec'y, 87; v.-pres, 95); Bot. Soc. Am. (pres, 02); Soc. Prom. Agric. Sci; fel. Ind. Acad. Sci, (pres, 93); Iowa Acad. Sci; Wash. Acad. Sci; Phila. Acad. Sci; Torrey Bot. Club; Int. Assoc. Bot.

Mycology; fungus diseases of cultivated crops; development of plant rusts.

BAILEY, HARRIET BROWN, N. Y. City. Deceased, Nov. 25, 05. **N. Y. Bot. Garden, 02–04.** Wild Flower Pres. Soc. Am.

BANKER, HOWARD JAMES, De Pauw Univ, Greencastle, Ind. b. Schaghticoke, N.Y, April 19, 66. Syracuse, A.B, 92; Columbia, A.M, 00, Ph.D, 05; **N. Y. Bot. Garden, 99–00, 02, 03–04, 05, 06.** Instr. biol, S. West. Nor. Sch, California, Pa, 10–04; *prof. De Pauw, 04–.* Fel. A. A. A. S; Bot. Soc. Am; Torrey Bot. Club.

Mycology.

BANTA, MAY, Wellesley, B.S, 89; **N. Y. Bot. Garden, 99–00.**

BARNHART, JOHN HENDLEY, 34 Windle Park, Tarrytown, N.Y. b. Brooklyn, N. Y, Oct. 4, 71. Wesleyan, A.B, 92, A.M, 93; Columbia, M.D, 96; **N. Y. Bot. Garden, 01–03.** ***Ed. asst, N. Y. Bot. Garden, 03–, librarian, 07–.*** Fel. A. A. A. S; Am. Soc. Nat; Torrey Bot. Club, (editor-in-chief, 03–07); N. Y. Bot. Garden, (life mem.); Biol. Soc. Wash.

Botanical bibliography and nomenclature; taxonomy of flowering plants; local floras of North America.

BARRETT, ALICE IRENE, Deceased. **N. Y. Bot. Garden, 00–01.**

BARRETT, MARY FRANKLIN, Wellesley College, Wellesley, Mass. b. Bloomfield, N. J, August 25, 79. Smith, B.L, 01; Barnard, 01–02; Woods Hole Marine Biol. Lab, 02; Columbia and **N. Y. Bot. Garden, 03–06;** Columbia, A.M, 05; Cornell, summer session, 06. Tea, H. S, Verona, N. J, 04; tea. sci. and math, Randolph-Pond Sch, N. Y. C, 05–06; *instr. bot. Wellesley, 06–.* Torrey Bot. Club.

Taxonomy of fungi.

BATESON, CHARLES EDWARD WAGSTAFFE, 145 West 58 St, N. Y. C. Columbia, E.M, 02, A.M, 05 ; **N. Y. Bot. Garden, 04–05.**

Paleobotany.

BENEDICT, RALPH CURTIS, N. Y. Bot. Garden, N. Y. C. b. Syracuse, N. Y, June 14, 83. Syracuse, A.B, 06. Asst. biol, Syracuse, 05–06 ; ***student and aid, N. Y. Bot. Garden, 06–.***

Taxonomy of pteridophytes.

BILLINGS, ELIZABETH, 279 Madison Ave, N. Y. C. b. Woodstock, Vt, 71. Barnard (spec. student), 95 ; **N. Y. Bot. Garden, 02–03, 04, 05, 06, 08–.** N. Y. Acad. Sci. (life mem.) ; Torrey Bot. Club ; N. Y. Bot. Garden (life mem.).

Paleobotany, Taxonomy.

BLODGETT, FREDERICK H, College Park, Md. b. Rockford, Ill, Sept. 12, 72. Rutgers Coll, B.S, 97 ; M.S, 99 ; **student and aid, N. Y. Bot. Garden, 00–01 ;** asst. curator (botany), Field Columbian Mus, 01 ; asst. State Path, Maryland Agric. Coll, 01–06 ; *grad. student-asst. bot, Johns Hopkins, 06–.* Fel. A. A. A. S.

Embryology and Ontogeny.

BRACKETT, MARY M. 604 W. 115 St, N. Y. C. N. Y. C. Nor. Coll. 93 ; **N. Y. Bot. Garden, 04.** *Sec'y Wadleigh H. S. (N. Y. C.), 05–;* asst. ed, Plant World, 06–. Torrey Bot. Club. A. A. A. S.

BRAISLIN, ANNA PRISCILLA, (Mrs. Thomas H. Montgomery, Jr.). Vassar, A.B, 97 ; Univ. of Penn, Philadelphia ; **N. Y. Bot. Garden, 99–00.**

BRANDENBURG, ELLEN KLAPP, 915 French St, Washington, D. C. b. Philadelphia, Pa, 82. Columbian, B.S, 04 ; Harvard Summer Sch, 03 ; Cold Spring Harbor, 05 ; Cornell Summer Sch, 06 ; ***N. Y. Bot. Garden, 07–.*** Instr. in biol. and english, Washington H. Schs, 04–07.

Botany ; mycology.

BROADHURST, JEAN, Teachers College, Columbia Univ, N. Y. C. b. Stockton, N. J, Dec. 29, 73. N. J. State Nor. Sch. (Trenton), 92 ; Tea. Coll. Columbia, B.S, 03 ; **N. Y. Bot.**

Garden, 01–02. Asst. bot, Barnard Coll, 02–03; tea. N. J; State Nor. Sch, 03–06; *instr. biol, Tea. Col, 06–*. A. A. A. S. Torrey Bot. Club; Wild Flower Pres. Soc. Am. (2nd Stokes) prize essay, 04); Nat. Study Soc. *Editor, Torreya, 08–*.

Morphology.

BROOMALL, LAURA BAKER. Michigan, B.S, 98; **N. Y. Bot. Garden, 03.**

Embryology of spermatophyta.

BRUCKMAN, LOUISE, 1022 Lexington Ave, N. Y. C. b. New York, March 16, 72. N. Y. C. Nor. Coll, 87–91; N. Y. C. Nor. Coll, Pd.B, 95; N. Y. Univ, Pd.M, 95; B.S, 07; Cornell Summer Sch, 99; Cold Spring Harbor, 00, 01, 03; **N. Y. Bot. Garden, 00–01.** Tea, elementary Schools of N. Y. C, 92–02, *instr. biol, Girls' H. S. Brooklyn, N. Y. 02–*. Torrey Bot. Club.

Pedagogy of biology.

BRUES, CHARLES THOMAS, Milwaukee Public Museum, Milwaukee, Wis. b. Wheeling, W. Va, June 20, 79. Univ. Texas, B.S, 01, M.S, 02; **N. Y. Bot. Garden, 02–03;** fel. zool, Columbia, 02–03; Scholar zool, Columbia, 03–04. Special field agent, U. S. Dept. Agric, 04–05; member of staff, Marine Biol. Lab. Woods Hole, Mass, 03; *curator invert. zool, Milwaukee Pub. Mus, 05–*. Wisconsin Nat. Hist. Soc. (gen. sec'y, and ed. of their Quarterly Bull.); Sigma Xi; Washington Entomol. Soc; Entomol. Soc. Am; Assoc. Economic Entomol; fel. A. A. A. S; Wisconsin Acad. Scis, Arts and Letters.

Morphology of algae.

BYRNES, ESTHER FUSSELL, 193 Jefferson Ave, Brooklyn, N. Y. b. Philadelphia, Pa, Nov. 3, 67. Bryn Mawr, A.B, 91, A.M, 94, fel, 94–95, Ph.D, 98; Woods Hole, 91; **N. Y. Bot. Garden, 02–03,** Demonstr. biol, Vassar, 91–93; Bryn Mawr, 95–97; *tea. biol, Girls' H. S, Brooklyn, 98–*. Am. Soc. Nat; Mar. Biol. Assoc; fel. N. Y. Acad. Sci; N. Y. Assoc. Biol. Teas. (v. pres.).

Cytology, Zoology, Experimental morphology.

BUDINGTON, ROBERT ALBYN. Williams, A.B, 96, A.M, 99; **N. Y. Bot. Garden.**

BURLINGHAM, GERTRUDE SIMMONS, N. Y. Bot. Garden, N. Y.

C. b. Mexico, N. Y, April 21, 72. Syracuse, A.B, 96; Woods Hole, 99; **N. Y. Bot. Garden** and Columbia, **05–08.** Preceptress, Ovid (N. Y.) Union Sch, 98; tea. biol. sci, Binghamton (N. Y.) H. S, 98–05; *instr. biol. N. J. State Nor. Sch, Trenton, 98–.*

Biology, Mycology, Plant Physiology.

BUTLER, BERTRAM THEODORE, Helena, Mont. b. Nashua, Ia, March 22, 72. Hamline Univ, Ph.B, 01; *grad. stud, Columbia, 07–*; ***N. Y. Bot. Garden, 07–.*** Tea, elementary and High Schs, 90–98; instr. Sci, Montana Wesleyan Univ, Helena, Mont, 03-05; city supt. schs. and sci. tea, High Sch, Glendine, Mont, 05–07.

Regional botany.

CANNON, WILLIAM AUSTIN, Tucson, Ariz. b. Washington, Mich, Sept. 23, 70. Stanford, A.B, 99, A.M, 00; fel. Columbia, 00–02, Ph.D, 02. Asst. in bot, Stanford, 99–00; **lab. asst, N. Y. Bot. Garden, 02–03, (Carnegie fel.) 06;** ; resident investigator, Desert Bot. Lab, Carnegie Inst, Tucson, Ariz, 03-05; *member of staff, Dept. of Bot. Research, Carnegie Inst, 03–.* Fel, A. A. A. S; Bot. Soc. Am; Nat. Geog. Soc; Am. Forestry Assoc.

Structure of plant hybrids, biology of desert plants.

CARDIFF, IRA DIETRICH, Salt Lake City, Utah. b. Goshen Tp, Stark Co, Ill, June 20, 73. Knox, B. S, 97; Chicago, 99–04; Columbia, Ph.D, 06; **N. Y. Bot. Garden, 04–05, (research sch.) summer, 06.** Asst. bot, Col. Univ, 04–07; *prof. bot. Univ. Utah, 06–.* A. A. A. S.

Morphology and cytology.

CARSS, ELIZABETH. Cornell, Ph.B, 95; **N. Y. Bot. Garden, 00–01.**

CLARK, ANNA MAY, Training School for Teachers, 241 East 119 St, N. Y. C. b. Brookfield, Vt, April 21, 74. State Nor. Sch, New Britain, Conn, 96; Vermont, Ph.B, 98; Tea. Coll, Columbia, Masters diploma, 04; **N. Y. Bot. Garden, 03–04;** Columbia, M.A, 04. Tea. sci, State Nor. Sch, New Britain, Conn, 98–99; tea. sci, State Nor. Sch, Framingham, Mass, 99–

03; tea. sci. and nature study, N. Y. C. Training Sch. for Teas, 04–07; *first asst. and head of dept*, 07–.

Biology, botany and nature study.

CLEMENTS, FREDERIC EDWARD, Univ. of Minnesota, Minneapolis, Minn. b. Lincoln, Nebr, Sept. 16, 74. Nebraska, B.S, 94, A.M, 96, Ph.D, 98; **N. Y. Bot. Garden, 02.** Asst. bot, Nebraska, 94–97, instr, 97–01, adj. prof, 01–03, asst. prof, 03–05, assoc. prof. plt. physiol, 05–06; prof, 06–07; *prof. bot, Minnesota*, 07–. Sec.'y, Nebr. Bot. Surv, 94–; fel, A. A. A. S; Bot. Soc. Am; Geog. Assoc; Bot. Cent. States; Micros. Soc; Mycol. Soc.

Phytoecology.

CLEMENTS, MRS. F. E. (See Schwartz, Edith)

COKER, WILLIAM CHAMBERS, Chapel Hill, N. C. b. Hartsville, S. C, Oct. 24, 72. S. Carolina, B.S, 94; Hopkins, Ph.D, 01; Bonn, 01–02; **N. Y. Bot. Garden, 05, 07.** Asst. bot, Cold Spring Harbor, 00; *assoc. prof. bot, No. Carolina, 02–;* chief of bot. staff, Bahama Exped. of Baltimore Geog. Soc, 03. Fel, A. A. A. S; Am. Soc. Nat; Bot. Soc. Am; N. C. Acad. Sci. (*v. pres*, 07–).

Cytology, embryology.

COOK, MELVILLE THURSTON, Agric. Exp. Station, Newark, Del. b. Coffeen, Ill, Sept. 20, 69. De Pauw, 88–89, 91–93; Stanford, A.B, 94; De Pauw, A.M, 01; fel, Ohio State, 01–02, Ph.D, 04; **N. Y. Bot. Garden (research sch.) 07.** Prin, H. S, Vandalia, Ill, 94–95; instr. biol, De Pauw, 95–97; prof, 97–04; lecturer human embryol. Central Coll. Physicians and Surgeons, Indianapolis, 02–03; comp. anat, Med. Coll. Ind, 03–04; chief, dept. plt. path. and econ. entom, Estación Central Agronomica de Cuba, Santiago de las Vegas, Cuba, 04–07; *prof. bot, Delaware Coll, and plt. path, Del. Agric. Exp. Sta*, 07–. Fel, A. A. A. S; Assoc. Econ. Entomol; Ind. Acad. Sci.

Embryology; insect galls.

CRANE, AURELIA BLAIR, Scarsdale, N. Y. Barnard; **N. Y. Bot. Garden, 04–05.** Torrey Bot. Club.

Mycology.

CUMMINGS, CLARA EATON, deceased, Dec. 28, 06. b. Plymouth, N. H, July 13, 55. Wellesley, 76–79; Zürich, 86–87; **N. Y. Bot. Garden (Cinchona), 05.** Instr. bot, Wellesley, 79–87, assoc. prof, 87–03, prof, 03–06. Chief Ed. "Decades of N. A Lichens," and "Lichenes Boreali"; assoc. ed. Plt. World, 05–06; fel, A. A. A.. S; Soc. Plt. Morph. and Physiol. (v. pres, 04); Mycol. Soc; Torrey Bot. Club; Bost. Soc. Nat. Hist; Bost. Mycol. Club; Wild Flower Pres. Soc. Am.

Lichenology.

DARLING, CHESTER A, Columbia Univ, N. Y. C. b. Leon, N. Y, Oct. 4, 80. Albion, A. B, 04, A.M, 06; **N. Y. Bot. Garden** and Columbia, **06–.** Prof. biol, Defiance Coll, Defiance, O, 04–06; *asst. bot. Columbia, 06–.* Ohio State Acad. Sci.

Cytology, Plant physiology.

DELAFIELD, MRS. JOHN ROSS (see White, Violette S.)

DOW, BERTHA MCLANE, 123 West 80 St, N. Y. C. b. New York City, June 3, 69. Barnard (spec. student), 95 (certificate), 01–02; **N. Y. Bot. Garden, 00–01**; Woods Hole, summer 06. Instr. sci, Park Avenue Sch, N. Y. C, 01–05; *instr. sci, The Alcuin Prep. Sch, N. Y. C, 05–.*

Biology, teaching.

DUFOUR, ALICE, Stockbridge Hall, Yarmouth, Maine. b. Gallipolis, O, Aug. 22, 63. Ohio State, 97–99; Defiance, Ph.B, 99; fel. and asst. bot, Ohio State, 99–00; **N. Y. Bot. Garden, 00–01, 02–03,** Columbia, A.M, 03; Directora, Escuela Practica de Señoritas, Guatemala City, Cent. Am, 05–07; *principal, Stockbridge Hall, Yarmouth, Me, 07–.* Ateneo, Guatemala City, Cent. Am.

Sociology, botany.

DUNN, LOUISE BRISBANE, deceased Dec. 18, 02. Columbia, A.B, 97, A.M, 99; **N. Y. Bot. Garden, 99–00.**

DURAND, ELIAS JUDAH, Cornell Univ, Ithaca, N. Y. b. Canandaigua, N. Y, Mch. 20, 70. Cornell, A.B, 93, Sc.D, 95. **N. Y. Bot. Garden (research sch.) 05.** Asst. bot. Cornell, and asst. crypt. bot. Agric. Exp. Sta, 95–96, *instr. bot. 96–; asst. curator herb. 98–.* Fell. A. A. A. S; Bot. Soc. Am; Sigma Xi.

Mycology, Discomycetes, Embryology.

EATON, ELON HOWARD, Rochester, A.B, 90, A.M, 93; **N. Y. Bot. Garden, 99–00.**

EGGLESTON, WILLARD WEBSTER, Rutland, Vt. b. Pittsfield, Vt, Mch. 28, 63. Dartmouth, B.S, 91; student, Gray Herb, 97; studying *Crataegus*, Biltmore Herb, 07–08; **N. Y. Bot. Garden (research sch.), 08.** Studying and collecting, local flora of Vermont, 91–04; asst. city engineer, Rutland, 93–97; civil engineering, 97–04; **aid, N. Y. Bot. Garden, 04–07;** *lecturer, civil engineering, Biltmore Forest Sch, 08–.* A. A. A. S; Vermont Bot. Club; N. E. Bot. Club; Thayer Sch, Civil Engineers (Dartmouth).

Taxonomy of *Crataegus*. Arctic-alpine flora of New England.

EMERSON, JULIA TITUS, 131 East 66 St, N. Y. C. b. N. Y C, April 6, 77. Coll. Pharm. (Columbia), 98; Tea. Coll, Columbia, 98–99; Woods Hole, 99, 01, 03, 04; Briarcliff Manor Agric. Sch, 01; ***N. Y. Bot. Garden, 02–04, 04–.*** Spec. asst, plt. path, Purdue, 02; **lab. asst, N. Y. Bot. Garden, 03–04.** Torrey Bot. Club; Wild Flower Pres. Soc. Am.

Taxonomy of Mosses.

EVANS, HELENA, 205 W. Court St, Rome, N. Y. Syracuse, Ph.B, 01. **N. Y. Bot. Garden, 06–07.**

Mosses.

FAWCETT, EDNA HAGUE, Dept. Agric. Washington, D. C. b. Washington, D. C, Feb. 26, 79. Smith, B.L, 01; Barnard, 02–03; **N. Y. Bot. Garden, 04–05;** tea. pub. schs, Springfield, Mass, 01–02; tea, primary work and nat. study, Miss Keller's Day Sch, N. Y. C, 02–05; *Sci. asst. Bur. Plant Industry, (Lab. Soil Bact. and Water Purif. Invest.) U. S. Dept. Agric., Wash, D. C, 06–.*

Soil bacteriology.

GAGER, CHARLES STUART, N. Y. Bot. Garden, N. Y. C. b. Norwich, N. Y, Dec. 23, 72. Syracuse, A. B, 95; N. Y. State Nor. Coll, Pd.B, Pd.M, 97; Cornell, Ph.D, 02. Lab. asst. biol. Syracuse, 94–95; v. prin, Ives Sem, (Antwerp, N. Y.), 95–96; prof. biol. sci. and physiog, N. Y. State Nor. Coll. (Albany), 97–05; asst. bot. summer sch, Cornell, 01, 02; instr, 05; collaborator, Jour. Applied Micros, 01–02; **lab. asst, N. Y. Bot. Garden, 04–05**; acting prof. bot, Rutgers, 05; prof. bot, N. Y. Univ. summer sch, 05, 06; tea. biol, Morris H. S, N. Y. C, 05; ***director of the laboratories, N. Y. Bot. Garden, 06–;*** assoc. ed. Plant World, 05. A. A. A. S; fel. Am. Geog. Soc, 05–06; N. Y. State Sci. Tea. assoc. (mem. Committee on Physiog.) 01–04; Albany Entom. Soc. (Chart. mem.) 98–04, (v. pres, 98–99); Torrey Bot. Club (*Sec'y, 05–*); Soc. Exp. Biol. & Med, (Charter mem.); Am. Soc. Biol. Chemists; Bot. Soc. Am; N. Y. Club, Phi Beta Kappa; Sigma Xi.

Plant physiology; cytology.

GAINES, ELIZABETH VENABLE, 297 Ryerson St, Brooklyn, N. Y. b. Mossingford, Va, Ap. 25, 69. Vassar, 89; Mass. Inst. Tech, 92–94; Chicago, 98; Adelphi Coll, B.A, 99; **N. Y. Bot. Garden, 02–03.** *Instr. biol, Adelphi Coll, 99–.*

Sanitary biology.

GARDENER, JOHN R, Upper Univ. Iowa (Fayette), B.S, 90; Iowa State, C.E, 94; **N. Y. Bot. Garden, 00, and at various times thereafter.**

Taxonomy of Celastraceae of N. A.

GILMAN, CHARLES WINTHROP, Palisades, N. Y. **N. Y. Bot. Garden, 00–01.**

Mosses.

GLEASON, HENRY ALLAN, Univ. of Illinois, Champaign, Ill. Illinois, B.S, 01, M.A, 04; Columbia, Ph.D, 06; **N. Y. Bot. Garden, 05–06.** *Instr. bot. Illinois, 06–.* A. A. A. S; Torrey Bot. Club.

Taxonomy.

GORDON, CLARENCE EVERETT, Amherst, Mass. Mass. Agric. Coll, B.S, 01; Boston Univ, B.S, 03; Columbia, A.M, 05; **N. Y. Bot. Garden, 05–06.** *Asst. prof. zool. and geol. Mass. Agric. Coll, 05–.*

Zoology, Geology, Paleobotany.

GRIFFITHS, DAVID, U. S. Dept. Agric, Washington, D. C. b. Aboristwyth, Wales, Aug. 16, 67. So. Dakota Agric. Coll, B.S, 92, M.S, 93; Columbia, Ph.D, 00; **N. Y. Bot. Garden,** 99–00. Tea. scis, H. S, Aberdeen, S. Dak, 93–98; prof. bot. Ariz, and bot. Ariz. Agric. Exp. Sta, 00–01; *asst. div. agrost, U. S. Dept. Agric, 01–.* Fel, A. A. A. S; Bot. Soc. Am; Nat. Geog. Soc; Bot. Soc. Wash; Wash. Acad. Sci; Torrey Bot. Club.

Gramineae; forage plants.

GROUT, LEON EVERETT, Jamaica, Vt. b. Newfane, Vt, Sept. 14, 77. Univ. of Vt, B.S, 02; Tea. Coll, Col. Univ. and **N. Y. Bot. Garden, 02–03.**

Agriculture.

GRUENBERG, BENJAMIN C, 69 West 88 St, N. Y. C. b. Czernowitz, Austria, Aug. 15, 75. Minnesota, B.S, 96; N. Y. Univ. Sch. of Pedagogy, 01–02; **N. Y. Bot. Garden, 02–06**; Columbia, A.M, 04. Sugar testing lab, U. S. Appraisers' Stores, N. Y. C, 98–02; *instr. biol, High Schs, N. Y. C, 02–;* tea. Evening Schools, N. Y. C, 02–03, 04–07; lecturer biol, Rand Sch. Social Sci, 07. A. A. A. S; N. Y. High Sch. Teas. Assoc; N. Y. Assoc. Biol. Teas.

Botany: Physiology of Nutrition; Zoology: Tropisms, etc. Mechanics of animal behavior; Pedagogy of science teaching.

HANKS, LENDA TRACY, 425 Nostrand Ave, Brooklyn, N. Y. b. New York, Jan. 1, 79. Columbia, A.B, 01, A.M, 02; **museum aid N. Y. Bot. Garden, 01–02**; Adelphi Coll, 03–04. Tea. sci, Adelphi Acad, Brooklyn, N. Y. C, 03–04; tea. biol, Girls Tech. H. S, 04–05; *tea. biol, Girls High Sch, 05–.* Torrey Bot. Club; Linnaean Soc.

Biology.

HARLOW, SARAH HAVENS, Norfolk, Conn. b. Florida, Orange County, N. Y, Oct. 20, 67. Wellesley, B.S, 91; **N. Y. Bot. Garden, 99–01**; Columbia, 00–01, A.M, 01. Tea. Amer. Collegiate Inst, Smyrna, Turkey, 93–96; Tuxedo Park Sch, Tuxedo Park, N. Y, 96–99; Randolph Cooley Sch, Plainfield, N. J, 01–03; *Private tutor, Norfolk, Conn, 04.*

HARPER, ROLAND MCMILLAN, College Point, N. Y. b. Farmington, Me, Aug. 11, 78. Univ. of Georgia, B.A, 97; **N. Y. Bot. Garden, 99–05**; Columbia, Ph.D, 05. Aid, U. S. Nat.

Herb, 01, 02; Forestry Collector, Geol. Surv. Ga, 03–04; **Museum Aid, N. Y. Bot. Garden, 04**; Bot, Geol. Surv. Ala, 05–06; Forestry Asst, Am. Mus. Nat. Hist, 06. New Eng, Bot. Club; Torrey Bot. Club; Nat. Geog. Soc; N. Y. Acad. Sci; A. A. A. S; Columbia Ph.D. Assoc; Ga. Forest Assoc.

Geography. Phytogeography of Eastern North America, especially of the Georgia coastal plain.

HAYNES, CAROLINE COVENTRY, Highlands, N. J, and 16 East 36 St, N. Y. C. b. N. Y. C, April 13, 58. Graduated from Mrs. Sylvanus Reed's Sch, 76; ***N. Y. Bot. Garden, 02–.*** Torrey Bot. Club; Sullivant Moss Chapter (v. pres, 08); Wild Flower Pres. Soc. Am; N. Y. Bot. Garden (Ann. Mem.).

Hepaticae.

HAZEN, TRACY ELLIOT, Barnard College, N. Y. C. b. Jericho Center, Vt, July 4, 74. Vermont, A.B, 97; Columbia, A.M, 99, Ph.D, 00; **N. Y. Bot. Garden, 99–00.** Director, Fairbanks Mus. Nat. Sci, St. Johnsbury, Vt, 01–02; asst. bot, *Barnard*, 02–03, tutor, 03–07, *instr, 07–*. Fel, A. A. A. S; Bot. Soc. Am; Torrey Bot. Club; New Eng. Bot. Club; Vt. Bot. Club.

Algae, chiefly Chlorophyceae.

HENRY, FLORENCE (Mrs. Hervey W. Shimer), Mass. Inst. of Technology, Boston, Mass. b. Sacramento, Calif, Sept. 24, 79. N. Y. State Nor. Sch. Cortland, 97; Cornell, A.B, 01; Columbia, A.M, 02; Columbia and **N. Y. Bot. Garden, 02–03.**

HEWINS, NELLIE PRISCILLA, Elmhurst, N. Y. b. Maspeth, N. Y, Jan. 20, 78. Cornell, B.S, 98; Grad. stud, Cornell, 98–99; Columbia, A.M, 00; Secondary diploma, Tea. Coll, 00; Cold Spring Harbor Summer Sch, 01; Cornell Summer Session, 05; Alliance Française, Paris, Summer, 03; Stern Sch. of languages, 03–05; **N. Y. Bot. Garden, 99–00, 04–05**; *Tea. Coll. (Columbia), 06–;* Columbia Summer Sch, 07. Tea. sci, South Orange H. S, 01; *instr. biol, Newtown H. S, Elmhurst, L. I, 01–*. Torrey Bot. Club.

Teaching of Biology in Secondary Schools.

HOCKADAY, ELA, Sherman, Texas. No. Texas Nor. Sch; **N. Y. Bot. Garden, 05–06.**

Lichen flora of Texas. Morphology.

Holm (Herman) Theodore, Brookland, D. C. b. Copenhagen, Denmark, Feb. 3, 54. Grad, Copenhagen, 80; Catholic, Ph.D, 02; **N. Y. Bot. Garden (research sch.), 03.** Botanist and Zoologist, Danish North Pole Exped, 81–82; travelled in West Greenland as botanist and zoologist for the Danish Gov't, summers of 84–86; asst. bot, U. S. Nat. Mus, 88–93; U. S. Dept. Agric, 93–96. Danish, Swedish, French, German and Canadian sci. societies.

Anatomy and morphology of phanerogams.

Horne, William Titus, Estación Central Agronomica, Santiago de las Vegas, Cuba. Univ. of Nebraska, B.S, 98; grad. stud, 98–00; fel, Columbia, 03–04; **N. Y. Bot, Garden, 03–04.** Instr. bot, Nebraska Wesleyan Univ, 98–00; instr. bot, Sch. Agric, Univ. Neb, 99–00; Botanical Seminar (Univ. Neb.).

Botany.

House, Homer Doliver, N. Y. Bot. Garden, N. Y. C. b. Oneida, N. Y, July 21, 78. Syracuse Univ, B.S, 02; **N. Y. Bot. Garden, 02–03**; Columbia, M.A, 04. Asst. bot, Columbia, 03–04; substitute tea. bot, Rutgers, 04; aid, U. S. Nat. Mus, Div. Plts, 04–05; Bur. Plt. Industry, Dept. Agric, 05–06; assoc. prof. bot. and bact, Clemson Coll, S. C, 06–07; ***aid, N. Y. Bot. Garden, 07-.*** Torrey Bot. Club.

Taxonomy.

Hoyt, William Dana, 609 Lennox Street, Baltimore, Md. b. Rome, Ga, April 16, 80. Georgia, A.B, 01, M.S, 04; *Hopkins, 04–;* **N. Y. Bot. Garden, 07.** Tutor biol, Univ. Georgia, 01–04. Phi Beta Kappa.

Plant physiology, algae.

Humphreys, Edwin William, 2155 Bathgate Ave, N. Y. C. b. New Jersey, June 15, 83. Coll. of the City of N. Y, A.B, 03; Columbia Summer Sch, 04, 05, M.A, 06; **N. Y. Bot. Garden, 05–06.** *Tea. Elementary Schs, N. Y. C, 03–.*

Geology, Paleobotany.

Irving, Mrs. Leonard (See Rennert, Rosina Julia).

Isham, Florence, **N. Y. Bot. Garden, 02–03.**

Taxonomy of local sedges.

JACKSON, HERBERT SPENCER, Newark, Del. b. Augusta, N. Y, Aug. 29, 83. Cornell, A.B, 05; **N. Y. Bot. Garden, 07.** Asst. bot. (Mycology), Cornell Summer Sch, 04; asst. bot. (Mycology), Cornell, 04–05; *asst. plt. path, Delaware Coll. Agric. Exp. Sta, Newark, Del, 05–; instr. bot, Delaware Coll, 05–.*

Mycology, plant pathology, flora of Delaware.

JOHNSON, DUNCAN STARR, Johns Hopkins Univ, Baltimore, Md. b. Cromwell, Conn, July 21, 67. Wesleyan, B.S, 92; Hopkins, Ph.D, 97; Tropical Lab, **N. Y. Bot. Garden (Cinchona), 03, 06.** Curator, Mus. Brooklyn Inst, 97; Munich, 01; *in charge crypt. bot, Biol. Lab. Brooklyn Inst, 96–;* assoc. bot, *Hopkins,* 98–01; assoc. prof, 01–05; *prof, 05–.* Bot. Soc. Am. (*Sec'y, 06–*); fel, A. A. A. S; Torrey Bot. Club.

Plant embryology, marine algae.

KELLICOTT, WILLIAM ERSKINE, Woman's College, Baltimore, Md. b. Buffalo, N. Y, April 5, 78. Ohio State, Ph.B, 98; Columbia, Ph.D, 04; **N. Y. Bot. Garden, 99–00.** Asst. zool, Barnard, 01–02, tutor, 02–05, instr. 05–06; *prof. biol. Woman's Coll. Baltimore, 06–.* N. Y. Acad. Sci.

Vertebrate morphology and embryology.

KERN, FRANK DUNN, Purdue Univ, Lafayette, Ind. b. Reinbeck, Ia, June 29, 83. University of Iowa, B.S, 04; Purdue Univ, M.S, 07; **N. Y. Bot. Garden, 06, research sch, 07, 08;** lab. asst. in animal morph. and physiol, Univ. of Ia, 02–04; spec. agt. Bur. of Plt. Industry, U. S. Dept. Agric, 04–05; *asst. bot. Purdue Univ. Agric. Exper. Sta, 05–.* Ind. Acad. Sci; A. A. A. S; Amer. Forestry Assoc; Amer. Breeders Assoc; Torrey Bot. Club; Sigma Xi.

Mycology, Uredinology.

KIMURA, TOKUZO, 501 West 22 St, N. Y. C. b. Hirobuchi, Miyagiken, Japan, Dec. 2, 80. Nogakushi from Sapporo Agric. Coll, Japan, 03; Stanford, A.B, 06; *grad. stud. Columbia, 07–;* ***N. Y. Bot. Garden, 07–;*** Tohoku Gakuin Missionary Coll, Sendai, Japan, 01–03.

Biology, Sex-determination, Artificial Parthenogenesis.

KING, CYRUS AMBROSE, 661 Flatbush Ave, Brooklyn, N. Y. C.

b. Plum Tree, Ind, June 6, 67. Indiana, A.B, 93; Harvard, A.B, 97, A.M, 98, Ph.D, 02; **N. Y. Bot. Garden, 03–04, 05.** Tea. nat. sci, H. S, Decorab, Ia, 93–96; asst. bot, Harvard, 96–00; asst. bot, Harvard Summer Sch, 97–01; Radcliffe, 99–00; instr, Indiana, 00–02; instr, in charge Bot. Biol. Sta, Indiana Univ. Summer Sch, 02; tea. biol, De Witt Clinton H. S, N. Y. C, 02–07; *first asst. biol, Erasmus Hall H. S, Brooklyn, 07–.* Fel, A. A. A. S; Soc. Nat. Cent. States; Torrey Bot. Club; N. Y. Assoc. Biol. Tea.

Cytology.

Kirkwood, Joseph Edward, Hacienda de Cedros, Mazapil, Zac. Mex. b. Cedar Rapids, Ia, Jan. 24, 72. Pacific Univ, A.B, 98; special fel. in biol, Princeton, 98–99, A.M, 02; Columbia and **N. Y. Bot. Garden, 99–01, 02, 04 (research sch.)**; Columbia, Ph.D, 03. Asst. in bot, Columbia Summer Sch, 00; asst. in biol, Tea. Coll, Columbia, 00–01; instr. bot, Syracuse, 01–03; assoc. prof. bot, 03–07; prof. bot. and head of dept, 07; *asst. bot, Dept. Investigation, Continental-Mexican Rubber Co, 07–.* Fel, A. A. A. S; Sigma Xi; Torrey Bot. Club; Bot. Soc. Am.

Economic Botany, Embryology, Ecology.

Knox, Alice Adelaide, Care of Miss M. F. Knox, Lakewood, N. J. b. Point Pleasant, N. J, Aug. 28, 76. Smith, A.B, 99; Columbia, A.M, 06; **N. Y. Bot. Garden, 04–05.** Demonstr. bot, Smith, 00–01; asst. bot, Barnard, 03–05; asst, Cold Spring Harbor, 04; **lab. asst, N. Y. Got. Garden, 05–06**; asst, Dept. Bot. Res. Carnegie Inst, 06–07; teacher, The Knox School, Lakewood, N. J. Torrey Bot. Club; Barnard Bot. Club.

Plant morphology and physiology

Kornmann, Elsie W, Nor. Coll, N. Y. C; **N. Y. Bot. Garden, 00–01.**

Kupfer, Elsie M, Cedarhurst, N. Y. b. Bayreuth, Germany, Sept. 5, 77. Barnard, A.B, 99; Columbia, A.M, 01; Ph.D, 07; *Columbia and **N. Y. Bot. Garden, 01–.*** Asst. bot, Columbia summer session, 01, 02; tea. biol, L. I. City H. S, 02; *tea. biol, Wadleigh H. S, 03–.* Torrey Bot. Club; Wild Flower Pres. Soc. Am.

Plant physiology.

LEAVENWORTH, GEORGE, St. Genevieve, Mo. b. St. Genevieve, Mo, Sept. 30, 75. Missouri, A.B, 02; **N. Y. Bot. Garden, 02–03**; Columbia, 03.

Forestry.

LEWIS, IVEY FOREMAN, Cor. Fayetteville and Hargett Sts, Raleigh, N. C. No. Carolina, A.B, 02, M.S, 03; Hopkins, 03–07; **N. Y. Bot. Garden (Cinchona), 06**; Marine Biol. Lab, Naples, 07–08.

Algae.

LIVINGSTON, BURTON EDWARD, Desert Bot. Lab, Carnegie Inst, Tucson, Ariz. b, Grand Rapids, Mich, Feb. 9, 75. Michigan, B.S, 98; Chicago, Ph.D, 01. **N. Y. Bot. Garden, 03 (research sch.), 05.** Asst. bot. lab, Michigan, 95–98; instr. sci, H. S, Freeport, Ill, 98–99; asst. plant physiol, Chicago, 99–04, assoc, 04; field work, Mich. Geol. Surv, 01; collaborator, U. S. Bur. Forestry, 02; instr. biol, summer sch, Easton, Ill. State Nor. Sch, 03; Carnegie research asst, 04; soil expert, U. S. Bur. Soils, 05–06; *mem. staff, Desert Bot. Lab, Carnegie Inst, 06–*. Fel, A. A. A. S; Am. Soc. Nat; Bot. Soc. Am. Walker prize, Boston Soc. Nat. Hist, 03.

Plant physiology and ecology; Soil Physics.

LIVINGSTON, MRS. FLORA VIRGINIA, Scarsdale, N. Y. **N. Y. Bot. Garden, 04, 05.**

Mycology.

LOCKE, EMILY PAULINE, 72 Mt. Auburn St, Watertown, Mass. Smith, B.L, 00; **N. Y. Bot. Garden, 02.**

Embryology of spermatophyta.

MACINTYRE, LUCY, 303 West 74 Street, N. Y. C. b. New York City, Dec. 5, 64. Miss Leverett's School, N. Y. C, 73–79; The Misses Graham School, 79–83; Dresden, Germany, 83–84; **N. Y. Bot. Garden, 03–04, 05, 06, 07, 08.** Torrey Bot. Club; A. A. A. S; League for Political Education.

Morphology of algae. General bryology.

MARBLE, DELIA WEST, Bedford, N. Y. b. New York City, 68. Spec. stud, Columbia, 97–98, 05; **N. Y. Bot. Garden, 01–02.**

Private tutoring in botany. Torrey Bot. Club; Wild Flower Pres. Soc. Am.

Local Flora N. Y. C, Ferns and Mosses.

MATHEWSON, CHESTER A, Station A, Cincinnati, O. b. Cincinnati, O, Dec. 11, 78. Chicago, 99; Cincinnati, 01–03; Yale, 03–04; **N. Y. Bot. Garden, 04–05**; Columbia, B.S, 05; A.M, 06; *Coll. P. & S. (Columbia), 07–;* instr. Technical Sch. of Cincinnati, 98–03; Tea. Coll. (Columbia), 05–06; Plainfield (N. J.), H. S, 06–07; *H. S. Commerce, N. Y. C, 07–.* Am. Nat. Stud. Soc; N. Y. Assoc. Biol. Teas. (sec'y.).

MAXON, WILLIAM RALPH, U. S. Nat. Museum, Washington, D. C. b. Oneida, N. Y, Feb. 27, 77. Syracuse, Ph.B, 98; **N. Y. Bot. Garden, 03; research sch, 05. Asst, N. Y. Bot. Garden, 98**; aid, crypt. bot. *Div. of Plts, U. S. Nat. Mus, 99–05, asst. curator, 05–.* Fel, A. A. A. S; Linnaean Fern Chapter (pres, 00–01); Bot. Soc. Wash; Wash. Acad. Sci; Wild Flower Pres. Soc. Am, (charter mem.).

Taxonomy of ferns.

MIDDLETON, FLORENCE, 366 St. Nicholas Ave, N. Y. C. b. New London, Conn, Aug. 2, 63. Nor. Coll, N. Y. C, 85; Tea. Coll, Columbia, 00–02; Barnard, 02–08; Cold Spring Harbor, 04; **N. Y. Bot. Garden, 05–06.** *Asst. tea. biol, Wadleigh H. S, N. Y. C, 04–.* Wild Flower Pres. Soc. Am.

Biology, botany.

MILLSPAUGH, CHARLES FREDERIC, 5748 Madison Ave, Chicago, Ill. b. Ithaca, N. Y, June 20, 54. Ithaca Acad, 69–71; Cornell, 72–75; N. Y. Homoep. Med. Coll, M.D, 81; **N. Y. Bot. Garden, 03.** Prof. bot. W. Virginia, 91–92; *curator, Dept. Bot. Field Mus. Nat. Hist, 94–; professorial lecturer bot, Chicago, 95–; prof. med. bot, Chicago Homeop. Med. Coll. 96–;* Mem. Pan Am. Commission Med. Plants, 99–01. Wild Flower Pres. Soc. Am, (charter mem, director, 02–); Explorers Club; Broome Co. (N. Y.) Homeop. Med. Soc, (hon. mem.); Binghamton (N. Y.) Acad. Sci, (hon. mem.); Mexican Med. Soc, (hon. fel.); Brazilian Med. Soc; Torrey Bot. Club; A. A. A. S; Soc. Nat. Cent. States; Sigma Xi; Geog. Soc. Chicago; ed, Homeop.

Recorder, 89–90; has studied at **various times in herbarium, N. Y. Bot. Garden** and other Amer. herbaria, Kew, British Museum Nat. Hist, Linnaean Society, Owen's College, Manchester, Leyden, Berlin, Praag, Vienna, Florence, Geneva, and Paris.

Systematic botany.

MOLWITZ, ERNESTINE, 88 East 165 St, N. Y. C. Columbia, A.B, 02; **N. Y. Bot. Garden, 01–03.**

Plant anatomy and physiology.

MULFORD, FANNIE AUGUSTA, Hempstead, N. Y. b. Nevada City, Calif, Sept. 20, 55. **N. Y. Bot. Garden, 02–03.** Wild Flower Pres. Soc. Am, (charter mem.); Torrey Bot. Club.

Flora of Long Island.

MURRILL, WILLIAM ALPHONSO, N. Y. Bot. Garden, N. Y. C. b. Campbell County, Va, Oct. 13, 69. Virginia Polytechnic Inst, Agric. Course, 86; Mechan. Course and B.S, 87; Randolph-Macon Coll, B.S, 89; A.B, 90; A.M, 91; Cornell, Ph.D, 00; **N. Y. Bot. Garden, 01–04.** Prof. nat. sci, Bowling Green Sem, Va, 91–93; prof. nat. sci, Wesleyan Female Inst, Va, 93–97; Cornell, scholar in bot, 98–99; asst. crypt. botanist, 99–00; tea. biol, De Witt Clinton H. S, N. Y. C, 00–04; **asst. curator, *N. Y. Bot. Garden,* 04–05; first asst, 06–07; *asst. director, 08–.*** Sigma Xi; Torrey Bot. Club; Bot. Soc. Amer.

Mycology.

PALLISER, HELEN LETITIA, Vassar College, Poughkeepsie, N. Y. b. Bridgeport, Conn, May 4, 82. Barnard, A.B, 05; Tea. Coll, Columbia, 03–05; Columbia, A.M, 06; **N. Y. Bot. Garden, 05–06**; *asst. biol, Vassar, 06–.* Torrey Bot. Club.

Mycology.

POND, RAYMOND HAINES, Bonn Univ, Bonn, Germany. b. Topeka, Kansas, March 3, 75. Kansas State Agric. Coll, B.S, 98, M.S, 99; Univ. of Michigan, Ph.D, 02; **N. Y. Bot. Garden (research sch.), 05, 06, 07**; *Bonn Univ, Germany, 07–.* Asst. bot, Kan. State Agric. Coll, 95–97, asst. chem, 97–98; asst. in charge of herbarium, Univ. Michigan, 98–99, asst. plt. physiol, 99–00; spec. investigator, Bur. Fisheries, 99, 00, 01;

asst, bot. and path, Maryland Agric. Coll. & Exp. Sta, 00–01; instr. chem. and biol, Township H. S, Sterling, Ill, 02–03; prof. bot. and pharmacog, and director miscrop. lab, Northwestern, 03–07; asst. plt. physiol, Chicago, 06. Fel, A. A. A. S; Bot. Soc. Am; Bot. Cent. States; Sigma Xi; Am. Soc. Biol. Chem. (charter mem.).

Plant physiology.

RAND, EDITH EDWINA, 223 West 106 St, N. Y. C. b. Norwich, Conn. Smith, A.B, 99, fel, 99–00; Woods Hole Biol. Lab. fel. zool, 00, fel. bot, 01; **N. Y. Bot. Garden, 01–02**; Tea. Coll, Columbia, A.M, 02. Lab. asst, zool, Smith, 97–00; *tea. biol. sci, Horace Mann H. S, 02–.*

Botany.

REA, PAUL MARSHALL, The Charleston Museum, Charleston, S. C. b. Cotuit, Mass, Feb. 13, 78. Woods Hole, 98–99; Williams, A.B, 99; Columbia and **N. Y. Bot. Garden, 99–00**; Williams, A.M, 01; Columbia, 02–03. Asst. biol, Williams, 00–02; field asst, Bur. Forestry, U. S. Dept. Agric, 02, 03; *prof, Coll. of Charleston and director Charleston Mus, 03–; instr. Woods Hole, 06–.* Am. Ass. Museums (*Sec'y, 07–*); A. A. A. S; *ed, Bull. Charleston Mus, 03–.*

Museum administration, Zoology, Polychaetae, Oligochaetae, fauna of S. C.

RENNERT, ROSINA JULIA, (Irving, Mrs. Leonard), 366 W. 120 St, N. Y. C. b. N. Y. City, July 8, 78. Nor. Coll, N. Y. C, A.B, 97; Columbia, A.B, 01, A.M, 02; **N. Y. Bot. Garden, 99–01, 02–04.** Asst. tea. biol, Washington Irving H. S, N. Y. C, 02–03; Wadleigh H. S, N. Y. C, 03–07. A. A. A. S.

Plant anatomy and physiology.

ROBINSON, CHARLES BUDD, JR, Bureau of Science, Manila, P. I. b. Pictou, Nova Scotia, Oct. 26, 71. Dalhousie (Halifax), B.A, 91; Cambridge, Eng, non-collegiate, 97–98; Christ's Coll, 98–99; Columbia and **N. Y. Bot. Garden, 03–06**; Columbia, Ph.D, 06. Tea, Kings County Acad, N. S, 92–93; tea, Pictou County Acad, 93–97, 99–03; night schools, N. Y. City, (No. 3, Bronx), 03–06; **asst. curator, N. Y. Bot. Garden, 06–07;**

econ. bot, Bureau of Science, Phil. Govt, 08–. Torrey Bot. Club; Bot. Soc. Am; Nova Scotian Inst. of Sci; Sigma Xi.

Systematic botany, especially phanerogams of eastern Canada and the Philippine Islands.

ROBINSON, WINIFRED JOSEPHINE, Vassar College, Poughkeepsie, N. Y. b. Johnstown, Mich, Oct. 17, 67. Mich. State Nor. Coll, 92; Mich. Agric. Coll, summer, 94; Univ. of Mich, B.S, B.Pd, 99; Woods Hole Marine Biol. Lab, summer sch, 99, 00; **N. Y. Bot. Garden, 02, 03 (research sch.), 04, 07–08**; Columbia, M.A, 04. Instr, training dept, Mich. State Nor. Coll, 93–05; *instr. in biol, Vassar Coll, 00–;* **lab. asst, N. Y. Bot. Garden, 07–08.** A. A. A. S; Am. Soc. Nat; Torrey Bot. Club.

Biology, botany.

RUBRECHT, WILLIAM KELLER. Muhlenberg Coll, B.A, 01; **N. Y. Bot. Garden, 02.**

Algae and fungi.

SAGE, LILLIAN BELLE, 34½ East 12 St, N. Y. C, or Norwich, N. Y. b. Norwich, N. Y. Mt. Holyoke; Cornell, A.B, 01. **N. Y. Bot. Garden, 06–08.** *Tea. biol, Washington Irving H. S, N. Y. C, 04–.* Torrey Bot. Club; Sigma Xi.

Mosses.

SCHWARTZ, EDITH, (Mrs. F. E. Clements), University of Minnesota, Minneapolis, Minn. Nebraska, A.B, 98; **N. Y. Bot. Garden, 02.**

Experimental evolution.

SCOTT, GEORGE GILMAN. Williams, A.B, 98, A.M, 99. **N. Y. Bot. Garden, 99.**

Algae.

SEAVER, FRED JAY, No. Dakota Agric. Coll, Fargo, N. D. b. Webster Co, Ia, 77. Chicago, summer, 01; Morningside, B.S, 02; univ. scholar bot, State Univ. of Iowa, 02–03; spec. asst. to Dr. Arthur, Purdue, spring, 03; fel. bot, State Univ. of Iowa, 03–04, M.S, 04; fel. bot, Columbia, 06–07; **N. Y. Bot. Garden, 06–07.** Asst. bot, State Univ. of Iowa, 04–05; instr. (in full charge) biol, Iowa Wesleyan, 05–06; elected prof. biol, 06; *asst. prof. bot, N. Dak. Agric. Coll, 07–.* Fel. Iowa Acad. Sci; Sigma Xi.

Mycology.

SELBY, AUGUSTINE DAWSON, Ohio Agric. Exp. Station, Wooster, O. b. Athens Co, O, Sept. 2, 59. Ohio State, B.S, 93; **N. Y, Bot. Garden, 03–04.** Supt. schs, Huntington, W. Va, 84–86; principal, H. S, Ironton, O, 86–87; tea. bot, H. S, Columbus, O, 90–94; botanist and chemist, *Ohio Agric. Exp. Sta*, 94–02; *botanist, 02–.* Fel, A. A. A. S; Bot. Soc. Am; Bot. Cent. States; Ohio Hort. Soc. (chairman, Comm. Veg. Path, 95–08); O. Acad. Sci, (*pres*, 01); Columbus Hort. Soc, (sec'y, 88–89, 91–94); St. Louis Acad. Sci; Torrey Bot. Club.

Diseases of plants.

SHEAR, CORNELIUS LOTT, U. S. Dept. of Agric, Washington, D. C. b. Coeymans Hollow, N. Y, March 26, 65. N. Y. State Nor. Sch, Albany, N. Y, 88; Univ. Nebraska, 94–98; undergrad. scholar, 94–97; B. S, 97; grad. fel, 97–98; A.M, 01; **N. Y. Bot. Garden (research sch.), 03;** George Washington, Ph.D, 06; studied in various European laboratories and herbaria three months in 05. Spec. Field Agt. Div. of Agrost, U. S. Dept. Agric, summers of 95, 96 and 97; asst. agrost, *U. S. Dept. Agric*, 98–01; asst. path, 01–02; *path, 02–;* ed, Asa Gray Bull, 98–00; assoc. ed, Plant World, 00–05. Sigma Xi; fel, A. A. A. S; Bot. Soc. Am; Wash. Biol. Soc; Bot. Soc. Wash; Wild Flower Pres. Soc. Am. (charter mem.).

Plant Pathology.

SHIMER, MRS. HERVEY W. (see Henry, Florence).

SHIMER, HERVEY WOODBURN, Mass. Inst. of Technology, Boston, Mass. b. Martin's Creek, Pa, April 17, 72. Gettysburg, 91–93; Lafayette, A.B, 99, A.M, 01; Columbia, Ph.D, 04; **N. Y. Bot. Garden, 02–03;** Harvard, 04–05. Tutor mod. lang, Lafayette, 99–01; asst. paleont, Columbia, 01–03; non-res. lecturer stratig. geol, *Mass. Inst. Tech*, 03; *instr, 03–;* instr. Hist. Geol. and Physiog, Yale Summer Sch, 07. A. A. A. S; Boston Soc. Nat. Hist; Am. Anthrop. Assoc; Nat. Geog. Soc; Am. Forestry Assoc; Assoc. of Ph.Ds of Columbia; Sigma Xi.

Geology, stratigraphy, paleontology, etc.

SHOEMAKER, CORNELIA JANNEY. Swarthmore, A.B, 94; **N. Y, Bot. Garden, 01–02**; instr. Friends' Seminary, N. Y. C.

Plant physiology.

SHREVE, FORREST, Woman's College, Baltimore, Md. b. Easton, Md, July 8, 78. Hopkins, A.B, 01, Ph.D, 05; Bruce fel, 05–06; hon. asst, **N. Y. Bot. Garden (Cinchona), 05–06**; instr. in charge phanerogamic bot, Biol. Lab, Cold Spring Harbor, 04, 05; assoc. prof. bot, Woman's Coll, Baltimore, 06–08; *member of staff, Desert Bot. Lab, Carnegie Inst. Wash, Tucson, Ariz, 08–*. Torrey Bot. Club.

Plant ecology, regional botany.

SLATEK, FLORENCE W. Cornell, B.S, 00; **N. Y. Bot. Garden, 00–01.**

SLOSSON, MARGARET, 852 Lexington Ave, N. Y. C. b. Paris, France. **N. Y. Bot. Garden, 02–03, 04.** Linnaean Fern Chapter (sec'y, 00–01).

Pteridology.

STEWART, LILIAN, 533 Manhattan Ave, N. Y. C. Carlton College; **N. Y. Bot. Garden, 04–05.**

Plant physiology.

STOCKARD, CHARLES R, Columbus, O. Miss. Coll. Agric. and Mech. Arts, B.S, 99, M.S, 02; **N. Y. Bot. Garden, 04–05.**

Cytology.

STREETER, STELLA GEORGIANA, Cummington, Mass. b. Cummington, Mass, Aug. 6, 74. Smith, B.L, 98; **N. Y. Bot. Garden, 02–03**; Columbia, M.A, 03; Tea. Coll. Columbia, Masters Diploma, 03. Head dept. sci, H. S, Hempstead, N. Y, 99–02; tea. biol, H. S, Trenton, N. J, 04–07; *tea. bot, H. S, Jersey City, N. J, 07–*.

Plant physiology.

TORREY, JOHN CULTER, Cornell University Medical Coll, N. Y. C. b. Burlington, Vt, April 19, 76. Vermont, A.B, 98; **N. Y. Bot. Garden, 99–00**; Columbia, Ph.D, 02; *fel, Exp. Path, Med. Coll, Cornell, 04–*. Asst. zool, Columbia, 00–01; bacteriologist, Sea Side Hosp, Staten Id, N. Y, 03–04; asst. instr. histol. and bacter, Med. Coll, Cornell, 03–04. Soc. Exp. Biol. and Med; N. Y. Acad. Sci.

Medicine, pathology.

Uhlig, William Cullen, 242 Halsted St, East Orange, N. J. b. New York, Dec. 22, 70. Columbia, Ph.B, 96; Ph.D, 04; **N. Y. Bot. Garden, 02–03.** *Asst. analyt. chem, Columbia, 99–.* Soc. Chem. Industry; Nat. Geog. Soc.

Sanitation, water supply.

Valentine, Morris Crawford, 259 West 131 St, N. Y. C. b. N. Y. City, April 18, 76. Coll. City of N. Y, A.B, 96; Columbia (P. & S.), 96–98; Path. Inst. State Hospitals for Insane, 98–01; **N. Y. Bot. Garden, 04.** Tea. chem, Harlem (N. Y. C.) Evening H. S. for men, 00–04; asst. tea. biol, De Witt Clinton H. S, N. Y. C, 01–04; *Wadleigh H. S, N. Y. C, 04–.* A. A. A. S.

Teaching of biology.

Wang, Chung Yu, Care Lin Fong & Co, 29 West Houston St, N. Y. C. Univ. Tientsin, China, 99; Columbia, A.M, 04; **N. Y. Bot. Garden, 04–05.**

Paleobotany.

Watterson, Ada, (Mrs. Robert M. Yerkes), 30½ Mellen St, Cambridge, Mass. b. Cleveland, O. Columbia, A.B, 98, A.M, 00; **N. Y. Bot. Garden, 99–00**; Marine Biol. Lab, Cold Spring Harbor, 99, 01; Marine Biol. Lab, Woods Hole, 00, 06; Harvard Summer Sch, 06. Asst. bot, Barnard, 99–02, asst. bot. and zool, 01–02; tutor biol, Tea. Coll. (Columbia), 02–05; instr. nat. study, Summer Sch, Columbia, 04–05.

Plant and animal physiology.

Whipple, Dorris William. N. Y. Coll. Pharmacy, Ph.G, 01; **N. Y. Bot. Garden, 02.**

Bacteriology.

White, Violette S, (Mrs. John Ross Delafield), Riverdale-on-Hudson, N. Y. C, or 17 East 79 St, N. Y. C. **N. Y. Bot. Garden, 01–02.** Fel, Wild Flower Pres. Soc. Am; Torrey Bot. Club; N. Y. Bot. Garden (life mem.).

Taxonomy.

Wilcox, Edwin Mead, Auburn, Ala. b. Busti, N. Y, May 21, 76. Ohio State, B. S, 96; Harvard, A.M, 98, Ph.D, 99; fel, 99–00; **N. Y. Bot. Garden, 04.** Asst. bot, Ohio State, 94

97 ; prof. bot. and entom, Okla. Agric. and Mechan. Coll, 00–01 ; biol. and hort, Ala. Polytech, 01–04 ; *prof. bot, and plt. physiologist and pathologist, Ala. Exp. Sta, 04–.* Fel, A. A. A. S ; Am. Soc. Nat.

Plant anatomy.

WILKINS, LEWANNA, Eastern High School, Washington, D. C, or 1414 Girard St, Washington, D. C. b. Fairfax Co, Va, Jan. 21, 69. Wellesley, B.S, 91 ; Martha's Vineyard, summers 92, 94 ; Woods Hole, (Wellesley Coll. Table) 96 ; C. Hart Merriam's Camp, Mt. Shasta, Calif, summer 98 ; Goettingen, (Germ.), spring and summer, 01 ; Chicago, summer 05 ; Columbia, summer 07 ; **N. Y. Bot. Garden, two weeks in Sept, 07.** *Tea. biol, Eastern H. S, Washington, D. C, 92–.* Wild Flower Pres. Soc. Am, (charter mem.).

Taxonomy.

WILSON, GUY WEST, Upper Iowa Univ, Fayette, Ia. b. Carmel, Ind, June 19, 77. De Pauw, B.S, 02, A.M, 03 ; Purdue, M.S, 06 ; **N. Y. Bot. Garden, 06–07** ; prof. biol. and curator mus, Mount Union Coll, Alliance, O, 03–04 ; instr. bot, LaFayette (Ind.), H. S, 04–05 ; **aid, N. Y. Bot. Garden, 06–07** ; *prof. biol. and curator mus, Upper Iowa Univ, Fayette, Ia, 07–.* Ind. Acad. Sci.

Local Flora of Indiana. Mycology.

WOLD, EMMA MARIE, 658 Patterson St, Eugene, Oregon. b. Trondhjem, Norway, Sept. 29, 73. Oregon, A.B, 94, A.M, 97 ; Univ. Calif, Summer Sch, 03 ; Columbia and **N. Y. Bot. Garden, 04–05** ; *Univ. Oregon, 07–.* Instr. Sci, Eugene H. S, Eugene, Ore, 99–04 ; instr. biol, Mills Coll, Calif, 05–07.

Algae.

WOOD, GEORGE CLAYTON, 798 Lincoln Place, Brooklyn, N. Y. b. Mexico, Oswego Co, N. Y, Feb. 2, 78. Syracuse, A.B, 00 ; Columbia and **N. Y. Bot. Garden, 04–05** ; Tea. hist, Syracuse Class. Prep. Sch, 99–00 ; principal, Jefferson Gram. Sch, Little Falls, N. Y, 00–02 ; tea. biol, Port Richmond H. S, Port Richmond, Staten Id, N. Y, 02–03 ; *asst. tea. biol, Boys' H. S, Brooklyn, N. Y, 03–.* Amer. Acad. Soc. and Polit. Sci ; Brooklyn Inst.

Arts and Sci. (mem, exec. comm, dept. bot.); publisher H. S. Biol. Leaflet (periodical) Brooklyn, N. Y, 06–08.

Plant distribution and ecology, lichenology.

WORTHLEY, IRVING TUPPER. Cornell Forest Sch, 00–02; **N. Y. Bot. Garden, 03.**

Native and cultivated shrubs.

YAMANOUCHI, SHIGEO, Univ. of Chicago, Chicago, Ill. b. Tokyo, Japan, Sept. 7, 76. Tea. Coll, Tokyo, M.S, 98; Columbia and **N. Y. Bot. Garden, 04–05;** Chicago (including Woods Hole Marine Biol. Lab.), 05–07, Ph.D, 07. Asst. prof, Tokyo Tea. Coll, 04; *asst. bot, Chicago, 07–.* A. A. A. S.

Cytology.

YATSU, NAOHIDÉ, Columbia, N. Y. C. b. Tokyo, Japan, Sept. 8, 77. Imper. Univ, Tokyo, A.B, 00; Columbia, Ph.D, 05; **N. Y. Bot. Garden, 03–05.** Soc. Exp. Biol. and Med; Tokyo Zool. Soc.

Zoology, cytology, embryology.

YERKES, MRS. ROBERT M, (See Waterson, Ada).

YORK, HARLAN HARVEY, Univ. of Texas, Austin, Tex. De Pauw, B.S, 03; Ohio State, A.M, 05; stud. asst. chem, De Pauw, 01–02; tutor human anat. and physiol, De Pauw, 01–02; stud. asst. bot, De Pauw, 02–03; fel. bot, Ohio State, 03–04, asst. bot, 04–05; fel, Columbia and **N. Y. Bot. Garden, 05–06;** spec. asst. bot, Nat. Mus. (Wash.), 06; assoc. in bot. Biol. Lab, Cold Spring Harbor, 06, 07; elected spec. asst. Dendrology, Amer. Mus. Nat. Hist, 06; *instr. bot, Texas, 06–;* Ohio Acad. Sci; Tex. Acad. Sci; A. A. A. S.

Taxonomy.

ZELENY, CHARLES, Indiana Univ, Bloomington, Ind. b. Hutchinson, Minn, Sept. 17, 78. Minnesota, B.S, 98, M.S, 01; **N. Y. Bot. Garden, 01–02;** Chicago, Ph.D, 04. Instr. zool, *Indiana,* 04–07, *assoc. prof, 07–.* Fel, A. A. A. S; Soc. Zool.

Zoology.

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BOTANICAL EXPLORATION IN JAMAICA.

To the Scientific Directors,

Gentlemen: In continuation of botanical exploration of the West Indies previously authorized, I spent the month of March and part of the month of April in Jamaica, being absent from the Garden for this purpose from February 22 to April 16. I was accompanied by Mrs. Britton and Dr. Arthur Hollick, who assisted me in the collection, care and preparation of the large collection of plants and specimens secured, and, during the month of March, we were favored by the company and assistance of Mr. Wm. Harris, Superintendent of Public Gardens and Plantations of Jamaica.

Special attention was given to the flora of the coastal regions of the island and to that of hills and mountains near the coast, previous collecting on behalf of the Garden having been mainly accomplished in the interior. In order to carry the work forward efficiently, the schooner "Nellie Leonora" of Nassau, used by us on several occasions for botanical exploration in the Bahamas, was chartered from Mr. W. J. Pinder and sent to Kingston, where we found her upon our arrival on the steamer "Trent," on March 27.

Three days were given to outfitting and to visits to Hope Gardens, Kingston, where we were hospitably received by the Hon. Wm. Fawcett, Director of Public Gardens and Plantations, and where plants and specimens desirable for our collections were secured; some collecting was done in the vicinity of Kingston and at Hardware Gap in the higher mountains. I was cordially received at King's House by Sir Sydney Olivier, Governor of Jamaica, who had most kindly anticipated the needs of the expedition, upon the request of Mr. Fawcett, by issuing a general order to harbor masters and other officials, including the police, to aid our work in any way possible; this order relieved our schooner of all port charges, gave us efficient assistance just where it was needed, obtained for us time-saving information on many occasions, and was, altogether, most important in the prosecution of our work. I have expressed to His Excellency our keen appreciation of his valuable coöperation.

Mr. Harris, Dr. Hollick and I set sail in Kingston Harbor on the morning of March 2 and made our first stop the same day at Fort Henderson, at the mouth of the harbor, where the day was spent in studying the flora of the Salt Pond Hills, a very dry region abounding in cactuses and other plants requiring but little rainfall. Leaving Fort Henderson at daybreak on March 3, we reached Old Harbour Bay early in the afternoon, and went ashore on Little Goat Island, where we found, among other interesting species, the white-flowered vine-like tree *Vallesia glabra*, of the Dogbane Family, new to Jamaica. March 4 was given to collecting on the adjacent Great Goat Island; this island is interesting not only on account of certain rare trees growing there, but also because it is the only place inhabited by the iguana in Jamaica; we saw many of these large lizards, which, on being startled, race through the bushes with great speed, seeking refuge in holes and crevices of the limestone.

Sailing south and west the following morning, the day of March 5 was spent near the extreme southern promontory of Jamaica, between Portland Point and Rocky Point. Here we were delighted to find a primitive race of cotton (*Gossypium*) growing on a rocky plain elevated a few feet above the sea, and on the coastal sand dunes, over an area about a mile long and in places several hundred feet wide. The region is singularly devoid of weeds of cultivation, and the nearly complete absence of soil practically forbids cultivation. On the rocky plain the cotton plants attained an average height of about four feet, while on the sands they grow higher, sometimes up to fifteen feet. The small flowers of this interesting race open white in the morning and fade pink; the small pods are nearly round, pointed, and the cotton fiber is short and adheres to the seed. Some of the plants are very hairy, others very nearly without hairs. We secured a quantity of the seeds, some of which I immediately sent by mail to Mr. F. V. Coville, Chief of the Division of Botany, United States Department of Agriculture, Washington, D. C., for experimental work in plant breeding, and Mr. Harris took a supply to Hope Gardens; abundant museum and herbarium specimens were also collected. Among many interesting shrubs and trees observed here, the beautiful and rare *Catesbaea parviflora*, a low shrub of the Madder Family with small dark green leaves and snow-white berries, deserves special mention.

We anchored during the night in Carlisle Bay and early next morning, March 6, set sail for Bluefields, the course being west to Pedro Bluff, where we spent several days last September, and then nearly northwest, the total distance about fifty miles; an obliging "norther" blew vigorously during the day, and after some beautiful sailing we landed at the old castle at Bluefields early enough in the afternoon to make arrangements with the willing corporal of police for the ascent next day of Bluefields Mountain, and also had time to study the coastal thickets a mile or two west of the town.

Bluefields is classic ground biologically, for here resided the English naturalist Gosse during his visit to Jamaica, and it was mainly here that the materials for his books, entitled "The Birds of Jamaica" and "A Naturalist's Sojourn in Jamaica," were derived. We gave March 7 to the ascent of Bluefields Mountain, traversing some of the region studied by Gosse. Ponies were supplied by Police Corporal A. A. Williams, and Constable Wallace was detailed as guide. The land has been much cleared for cultivation since the visit of Gosse and it was only after long riding that we came to tracts of forest at altitudes of over 2,200 feet, where some species not heretofore collected by us were obtained, notable among them a fine red-flowered *Columnea*, a vine of the Gesneria Family, which we hope to introduce into cultivation, and three species of the bromeliad *Hohenbergia*, a genus well developed in Jamaica, and known, like other bromeliads, to the natives as "wild pine," the pine-apple belonging to the same natural family. We drifted across Bluefields Bay to Savanna-la-Mar, on the morning of March 8, arriving in time to pay our respects to Hon. Arthur W. Vickers, Custos of Westmoreland, and Mrs. Vickers at their sugar estate, "Fontabelle," where Mrs. Britton had been their guest for a week while collecting in the vicinity. Mr. and Mrs. Vickers gave us valuable information relative to the extreme western end of Jamaica, which we were next to examine botanically, and we gratefully appreciate their kindness and hospitality.

The land about Savanna-la-Mar is a plain almost all under cultivation, and of botanical interest mainly in its crops of sugar-cane and logwood. We therefore sailed westward at once on the morning of March 9, reaching Negril, at the southwestern point of the island, in the afternoon, and remained there until the afternoon of March 12, exploring the thickets and woodlands on the hills and near the coast, by aid of information and personal guidance of Mr. J. S. Brownhill, Lighthouse Superinintendent at Negril Point. These yielded specimens of many rare species, including the "wild sago" (*Zamia*), the existence of which in Jamaica was known only from a stem seen by Professor Grisebach in the botanical museum of the Royal Gardens, Kew, prior to 1860, but not preserved there at the present time. This fine cycad inhabits rocky woodlands east of Negril and is locally abundant. Its stem is nearly embedded in the soil, and its leaves reach a height of over three feet. March is evidently not its flowering season, but after long search Mr. Harris found a ripe cone, and several plants with staminate flowers were obtained. We dug out a quantity of the plants for cultivation, and for Museum specimens, these stems containing much starch, like their Bahamian congeners. Dr. Hollick made a careful drawing of the cone, which was afterwards preserved in formalin, so we obtained complete materials for the illustration of this interesting species. These rocky woods yielded also bulbs of a fine spider-lily (*Hymenocallis*) unknown to us. Opportunity was taken at Negril for exploring the borders of the Great Morass of Westmoreland, a marsh of large extent similar in some of its features to the Everglades of Florida. The rare tree *Crudya spicata* seen by us last September on the banks of Black River was again found, as well as the marsh cabbage palm (*Roystonea*), and ripe seeds of both were taken for germination. Here we found ourselves in a veritable forest of the long thatch palm (*Geonoma Swartzii*) with ripe fruit, a magnificent sight long to be remembered.

Sailing northward on March 13 we cast anchor in the afternoon in Green Island Harbour, and devoted the two days following to the hills in that vicinity, to those about Fish River and to the coast near Orange Bay. We were hospitably entertained by Arnold G. Clodd, Esq. at his estate, "Phoenix," where we found another rare spider-lily (*Hymenocallis*) on a rocky hill, and by other members of the Green Island Club. Mr. R. F. Lindo, of Fish River, kindly permitted us to examine his interesting woodlands, where we obtained specimens and seeds of a fine thatch palm (*Thrinax*) and of other interesting trees; we could have spent more time there to advantage. In Orange Bay River, under the guidance of Mr. W. A. Hewitt, we were much pleased to find quantities of the beautiful aquatic fern *Ceratopteris*, rare in Jamaica, and obtained needed specimens for comparison with the related species of South Florida for Mr. R. C. Benedict, who is studying this group of ferns for "North American Flora." We made the attempt to send living plants, in a large can of water, to Hope Gardens, in the hope of establishing them there and subsequently removing them to the aquatic house at the Garden, but the plant proved to be very tender and delicate, and the necessary delay in shipping until we reached the railroad at Montego Bay, has probably defeated us; through the aid of Mr. Hewitt, we hope to succeed at another time.

After beating the strong northeast wind nearly all day, the beautiful harbor of Lucea was reached in the afternoon of March 16 and here we anchored until the morning of March 21, giving four days to the study of Dolphin Head and adjacent hills and mountains some six miles back from the coast. Mrs. Britton had come to Lucea several days previous and had secured convenient quarters in a cottage on the shore; the collections had now become so large that the time of all members of the party was fully occupied in their increase, care and preservation and this condition obtained during the rest of the trip, one or two persons usually remaining in camp or on the boat with the specimens while the others collected. We are indebted to the Hon. Mr. Sanftleben, Custos of Hanover, for advice and aid.

Mr. Harris had made a previous visit to Dolphin Head and had obtained specimens of some rare plants, but his work was then hampered by almost continuous rain. This time we had two clear and splendid mountain days and two broken ones. The ascent is made from Askenish, a village at 600 feet elevation, reached by carriage from Lucea; Dolphin Head is 1,816 feet high. Its forests contain a variety of trees and shrubs not known to grow elsewhere, and our collections there include specimens of over two hundred species. An elegant white-flowered *Blakea*, a vine of the Melastoma Family, clothes the trees in places; the nickel tree (*Ormosia*), a tall forest tree related to our locusts, is endemic here, as is the red-flowered shrub *Gesneria scabra*, and there are many fine orchids and bromeliads. Here Mrs. Britton found rich collecting ground for mosses and hepatics. On a wooded foothill we found the magnificent tree *Hernandia* with its curious pouch-like, translucent fruits, each enclosing one black eight-ribbed seed; in order to secure these we had to have felled a tree over sixty feet high, with a trunk diameter of about two feet, and this afforded us an interesting illustration of the efficiency of the machete, our negro guide hacking this large trunk through with the long thin blade in less than half an hour, quite as expeditiously as one of our northern woodsmen would have done it with an axe and apparently with no greater effort. We had to fell many trees here and elsewhere in order to get their flowers or fruits, though in many instances they were had by climbing; this same guide gave us an unconscious expert exhibition of climbing on one occasion when we sent him up a fifty foot *Mayepaea*, and happened to notice that he balanced the machete on his head all the way up to the lowest branch, some thirty feet!

Montego Bay, reached on the afternoon of March 21, was made the base of operations until the afternoon of March 25. Here Dr. A. T. McCatty obligingly permitted us to use his sanatorium, on the shore, as a very convenient and hospitable working place; we are also indebted to Messrs. J. E. Kerr & Co. for courtesies and information. The collecting grounds were low hills near the bay, and the range of mountains some six miles to the southeast on which the Kempshot Observatory, established by Judge Maxwell Hall, is situated. On the coastal hills we found the creeping vine *Callisia*, of the Dayflower Family, not hitherto reported from Jamaica, and in the mountains about Kempshot many trees and shrubs not previously seen by us, including an undescribed species of prickly ash (*Zanthoxylum*) wholly devoid of prickles, another thatch palm (*Thrinax*), and the broad-stemmed *Rhipsalis*, an interesting climbing cactus.

Near Montego Bay we had a good opportunity to observe the disease of the cocoanut palm which has caused much damage to the crop in places, evidenced by the yellow color of the foliage, the small size and reduced number of the nuts produced, and the eventual death of the trees. The trouble seems to be caused by planting the trees on level stretches of land too little elevated to give them the drainage they require. We observed several groves in such situations between Montego Bay and Port Antonio and they were almost invariably affected, while those on slopes or on sand dunes were healthy. The simple remedy is to avoid planting cocoanuts in poorly drained soils. The same conditions obtain near Nassau, New Providence, Bahamas, where the trees are unhealthy over a large low level area where they have been planted.

Sailing from Montego Bay in the afternoon of March 25, the schooner reached St. Ann's Bay the next afternoon, and four days were then devoted to the study of the coastal vegetation from Roaring River Falls to Runaway Bay and to the hills a few miles to the south. The flora of the Parish of St. Ann's has been little known recently, and it proved to be quite different in many features from that of regions hitherto explored by us. The Roaring River, which reaches the sea about four miles east of St. Ann's Bay, is a picturesque stream and in its valley we found some interesting shrubs and trees; about two miles back from the coast it plunges over a rocky precipice, forming a very attractive cascade which is a landmark for mariners, being visible many miles from shore; near its mouth, where it passes under the road from St. Ann's Bay to Ocho Rios, there is a series of low waterfalls separated by nearly level stretches which present the curious aspect of many large trees growing directly in the water. These trees are mainly the "wild olive" (*Bucida Buceras*) and the large-leaved "anchovy pear" (*Grias cauliflora*). Their seeds germinate in the calcareous travertine or tufa deposited from the water, and individuals of all ages may be seen growing under these unusual conditions. This valley, containing these two remarkable natural features, ought to be made a park, and all encroachments of cultivation rigidly prevented; as it is, the land along the river at the foot of the cascade has already been cleared and cultivated and presents an unattractive aspect, much of it grown up with weeds: the natural features could be restored by judicious planting and care of native trees and shrubs. One can only imagine what a glorious natural landscape it must have presented before it was devastated for the production of a few dollars worth of agricultural products annually. Near Runaway Bay the land is a nearly level rocky plain, with many sink-holes, covered by low woods and thickets, physiographically much like portions of the Bahama Islands, and here grow several kinds of plants not seen by us elsewhere in Jamaica; this region would doubtless repay further investigation at another time of year. On the ocean cliffs at Eton Hall, Runaway Bay, grows the characteristic *Rhacicallis maritima*, a shrub of the Madder Family, known in Jamaica only at this point, but common on the coasts of other West Indian Islands; we were cordially received and entertained at Eton Hall by Rev. and Mrs. Geo. Leonard Chaney. At Liberty Hill, St. Ann's Bay, the Misses Stennart kindly furnished aid and information; from this hilltop a magnificent ocean view is obtained, the Cuban mountains being visible under favorable atmospheric conditions. We are also indebted to Mr. A. B. Berrie for letters of introduction and other assistance.

At this time Mr. Harris was obliged to return to Hope Gardens on account of the approaching retirement of Mr. Fawcett from the position of Director of Public Gardens and Plantations. Being especially desirous of learning more about the flora of St. Ann's Parish back from the coast, I concluded to abandon the further examination of the coastal region at this time, and on March 30 Mrs. Britton proceeded to Moneague, where a new base was established. I took the schooner to Port Antonio on March 31, and gave the next day to collecting on the hills a few miles to the southeast, and about the marshes east of the town, where I found quantities of a pretty yellow-flowered bladderwort (*Utricularia*).

I sent the schooner home to Nassau on April 2 and travelled by rail to Bog Walk, where I had a few hours time between trains for a study of the hillsides and the magnificent deep valley of the Cobre River. Here I met Dr. Hollick, who had remained for a week at Montego Bay, and proceeded with him in the afternoon by rail to Ewarton and by carriage to Moneague, where we rejoined Mrs. Britton. The party remained at Moneague until the morning of April 9, and, although hampered to some extent by rain, collected specimens of some 250 species, most of them different from those previously obtained. There is considerable original forest remaining on the hills and mountains of St. Ann's, and much time would be necessary to explore the region completely; we rediscovered some of the rare species found here by the older collectors. To F. B. Sturridge, Esq., of Union Hill, we are under special obligations for aid and hospitality; his beautiful estate, largely forest lands, reaches elevations of some 2,200 feet, and here we collected many varieties, including fine fruiting specimens of the thatch palm (*Thrinax tessellata*), previously observed in the neighboring hills at Hollymount, from which a crop of seedlings may be grown. We were also much pleased to see the large forest tree, black yacca (*Podocarpus Purdieanus*), of the Yew Family, from which fine specimens were obtained. Bromeliads, orchids, mosses and ferns were collected in variety.

The day of April 4 was given to the "Fern Gully," on the road from Moneague to Ocho Rios. We had heard much of this ravine, but were unpleasantly surprised to find that its great natural beauty has recently been vandalized by the planting of bananas and other food-plants and the necessary clearing of its sides for this purpose in places quite down to the roadway. It is really a great deprivation, at least to visitors, that this marring of the beauty of the gully should have been permitted ; the only apparent way to correct the evil is to make a park of the valley, clear out the extraneous bananas and other unnatural features and permit the wild ferns and other interesting plants to resume their former attractiveness and beauty.

Leaving Moneague on the morning of April 9, we proceeded to Kingston. The next day was given to packing the collections and to a visit to Ferry River, about six miles east, especially for specimens of the rare shrub *Bumelia rotundifolia*, of the Sapodilla Family, growing on the hillsides there, and for some water plants which inhabit that river and its banks. We boarded the steamer "Orinoco" in the evening and sailed for New York early next morning, arriving on April 16.

Altogether, on the expedition, 1,407 field numbers of specimens and plants were secured, the total number of specimens aggregating nearly 4,000, and to these are to be added some 400 collection numbers of Mr. Harris, of which we will receive the duplicates. The work has added materially to our knowledge of the West Indian flora and to its representation at the Garden.

My original plan for the expedition was to cross over to eastern Cuba for about ten days, after having spent most of March in Jamaica, and upon the request of Judge Addison Brown, Chairman of the Executive Committee of the Board of Managers of the Garden, the Commandant of the United States Naval Station at Guantanamo, Cuba, had been requested by the Honorable Secretary of the Navy to permit me to land there for the purpose of collecting plants and specimens and to facilitate this work. I found, however, that more time than I anticipated was necessary to accomplish what I wished to do in Jamaica, and also concluded that ten days in eastern Cuba would be insufficient to obtain what we desire from that region, so I decided to defer the Cuban work, and have so informed the Commandant at Guantanamo.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

NOTES, NEWS AND COMMENT.

Professor A. H. R. Buller, of the University of Manitoba, Winnipeg, recently visited the Garden to examine the collections of fungi.

A work on North American trees by Dr. N. L. Britton, assisted by Dr. J. A. Shafer, appeared May 6. This work is fully illustrated, and is comprehensive, including also many tropical species as well as those of temperate regions.

Dr. Small visited Washington and Baltimore late in April to examine collections of flowering plants in connection with his work on "North American Flora."

The herbarium of the late Professor A. P. Morgan has been given to the University of Iowa. A number of his specimens of fungi are to be found in the Ellis collection at the Garden. Professor Morgan was one of the leading mycologists of the country. Two others, Professor Underwood and Professor Kellerman, have died during the past winter.

The spring course of lectures to the 4B and 5B grades of the public schools of the Bronx, comprising fifteen lectures with accompanying demonstrations, began April 20 and closed May 22.

Mr. Percy Wilson recently visited Philadelphia and Washington to examine specimens of certain groups of plants which he is monographing for "North American Flora."

The eighth annual meeting and floral exhibition of the Horticultural Society of New York were held at the Garden on May 13 and 14. Dr. B. T. Galloway lectured before the Society on "The Foundations of Successful Violet Culture." A feature of the exhibition was the attractive display of orchids by the recently established Orchid Section.

The fifth annual botanical field "symposium" will be held at Georgetown, Delaware, July 6 to 12. The botanical clubs of Philadelphia and Washington will coöperate with the Torrey Botanical Club on this occasion as in former years.

Dr. Murrill visited Washington about the middle of April to examine the collection of Boleti at the Division of Vegetable

Pathology, and to confer with Dr. Metcalf, of the Division of Forest Pathology, regarding the distribution of the chestnut canker.

Meteorology for March. — The total precipitation recorded for March was 2.35 inches. Snow fell on the 2d, 3rd and 6th, hail on the 17th and 18th. Maximum temperatures were recorded of 51° on the 7th, 63° on the 16th, 79.5° on the 27th; also minimum temperatures of 20.5° on the 5th, 21° on the 10th and 21st, and 30° on the 26th.

Meteorology for April. — The total precipitation recorded for April was 2.22 inches. Maximum temperatures were recorded of 61° on the 2d, 77° on the 7th, 63° on the 13th, 84° on the 26th, 72° on the 28th; also minimum temperatures of 21.5° on the 5th, 31° on the 10th, 26° on the 17th, and 30° on the 21st.

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MUSEUMS AND HERBARIUM.

63 specimens of flowering plants from the eastern United States. (Given by Mr. J. J. Carter.)

1 specimen of diatomaceous earth from California. (Given by Mr. C. F. Cox.)

4 specimens of hepatics from Cuba. (By exchange with Prof. C. F. Baker.)

30 specimens, "North American Musci Pleurocarpi." (Given by Dr. A. J. Grout, for the Columbia Herbarium.)

221 specimens of *Rubus, Betula* and *Amelanchier.* (Distributed by Mr. W. H. Blanchard.)

2 specimens of *Senecio* and *Convolvulus* from South Carolina. (Given by Mr. K. K. Mackenzie.)

2 specimens of *Pinus* from Nantucket Island, Massachusetts. (Given by Mr. E. P. Bicknell.)

172 specimens of Canadian mosses. (Distributed by Mr. John Macoun.)

15 specimens of mosses from Japan and South America. (By exchange with General Paris.)

9 specimens of ferns from Connecticut. (Given by Mr. R. C. Benedict.)

16 specimens of ferns from Missouri and Pennsylvania. (Given by Dr. N. M. Glatfelter.)

62 specimens of grasses from Jamaica. (By exchange with the Department of Public Gardens and Plantations, Jamaica, West Indies.)

19 specimens of flowering plants from the eastern United States. (Given by Mr. E. B. Bartram.)

3 specimens of ferns from Indiana. (Given by Professor G. W. Wilson.)

9 specimens of *Viola* from South Carolina. (Given by Mr. H. D. House.)

75 specimens of flowering plants from British America. (By exchange with the Geological Survey of Canada.)

36 specimens of willows from Massachusetts. (Given by Mr. F. F. Forbes.)

3,500 herbarium specimens from Jamaica. (Collected by Dr. and Mrs. N. L. Britton and Dr. A. Hollick.)

23 specimens of mosses from Alaska, Oregon and California. (By exchange with Professor C. F. Baker.)

2 specimens of *Agrimonia* from Canada. (Given by Mr. E. P. Bicknell.)

12 specimens of flowering plants from Wyoming and Colorado. (Given by Dr. H. Hapeman.)

104 specimens of North American plants collected by C. A. Geyer. (By exchange with the British Museum.)

50 specimens, "Phycotheca Boreali-Americana," Fascicle 29. (Distributed by Messrs Collins, Holden and Setchell.)

1 specimen of rust from Nevada. (Given by Dr. P. B. Kennedy.)

2 specimens of *Entyloma compositarum* from Central Park. (Given by Dr. E. B. Southwick.)

1 type specimen of *Sorosporium confusum* from Newark, Delaware. (Given by Mr. H. S. Jackson.)

1 specimen of *Porodisculus pendulus* from Newark, Delaware. (Given by Mr. H. S. Jackson.)

7 specimens of *Boletus* from Missouri and Pennsylvania. (Given by Dr. N. M. Glatfelter.)

2 specimens of fungi from Forked River, New Jersey. (Given by Mr. W. H. Ballou.)

4 specimens of *Clitocybe dealbata deformata* from East Hartford, Connecticut. (Given by Mr. C. C. Hanmer.)

61 specimens of polypores from Fayette, Iowa. (Given by Professor G. W. Wilson.)

25 specimens, "Ustilagineen," Fascicle 9. (Distributed by Professors H. and P. Sydow.)

25 specimens, "Fungi Utahensis," Fascicle 6. (Distributed by Professor A. O. Garrett.)

PLANTS AND SEEDS.

1 plant of *Pandanus utilis* for conservatories. (By exchange with New York Zoölogical Society.)

2 tubers of *Dioscorea* sp. for conservatories. (Given by Dr. H. H. Rusby.)

61 plants from Jamaica for conservatories. (Collected by Dr. and Mrs. N. L. Britton.)

98 plants for woody collections. (Purchased.)

2 plants of *Citrus aurantiaca* for conservatories. (By exchange with New York Zoölogical Society.)

15 plants for conservatories. (By exchange with Mrs. B. B. Tuttle.)

2 plants of *Agave barbadensis* for conservatories. (By exchange with Missouri Botanical Garden.)

3 plants of *Furcraea tuberosa* for conservatories. By exchange with Missouri Botanical Garden.)

1 packet of Dwarf Sunflower seed. (Given by Dr. W. A. Murrill.)

1 packet of seed of *Ipomoea* sp. from Cuba. (By exchange with United States National Museum, through Dr. J. N. Rose.)

2 packets of seed of *Atractylis gummifera*. (Given by Mr. H. C. Pearson.)

1 packet of seed of *Agave angustifolia*. (By exchange with Missouri Botanical Garden.)

3 packets of seed. (Given by Dr. H. H. Rusby.)

13 plants derived from seed from various sources.

PLANE-TREE NEAR MUSEUM BUILDING AFFECTED WITH LEAF BLIGHT.

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LEAF BLIGHT OF THE PLANE-TREE.

A brief account of this disease, with illustrations, was given in the JOURNAL for July, 1907, when the plane-trees on the grounds of the Garden had somewhat recovered from a severe attack that began in May and lasted through the month of June. This serious outbreak of the disease was due to the remarkably late and wet spring. Many other diseases caused by fungi also develop rapidly under such conditions. Several plane-trees in the Garden were examined at the time and in every case the fungus (*Gloeosporium nervisequum*) was found to be present in the injured leaves and twigs. The presence of the fungus was also reported by investigators in other localities.

In the report of the botanist of the Connecticut Agricultural Experiment Station issued in May, 1908, Dr. G. P. Clinton refers to the death of the young leaves of the plane-tree (*Platanus occidentalis*) in the spring of 1907, and ascribes the injury entirely to the severe frosts of May 11 and May 21. Dr. H. von Schrenk held the same opinion last year, and published a short article in the report of the Missouri Botanical Garden, describing "frost injuries" to the plane-trees in the Mississippi Valley and eastward.

The blight was first noticed here this year on May 22, after several days of rainy weather. All of the plane-trees on the grounds were attacked, but most of them recovered in about two weeks, the spring weather being very different from that of 1907. As predicted last year, the terminal twigs were nearly all dead, and the new shoots were from lateral buds a foot or more from

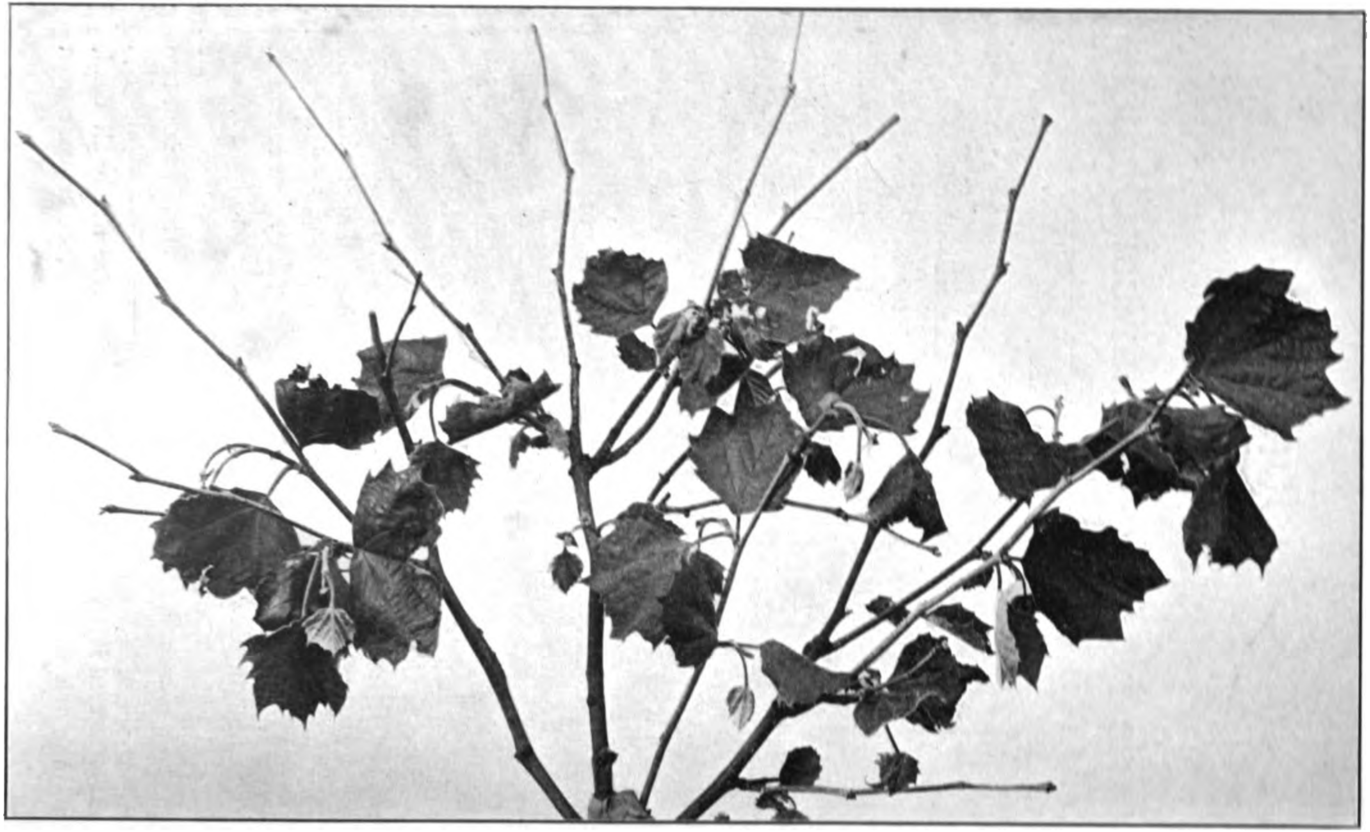


FIG. 13. Twigs from plane-tree shown in frontispiece.

the tips of the branches. The accompanying illustrations, made from the same tree figured in last year's JOURNAL, show the condition of the tree and its smaller branches on May 25, 1908. The fungus present in the small pustules on the dead twigs is *Hymenula platani* Lév. (*Discula platani* Peck), considered a mere form of the *Gloeosporium nervisequum*, which attacks the opening buds.

W. A. MURRILL.

ADULTERANTS IN FOODS AND DRUGS AND THEIR DETECTION.*

A very earnest and intelligent salesman for one of our largest wholesale grocery houses recently assured me that the most depressing feature connected with his business, namely, competition against grossly adulterated goods, has been largely eliminated by the pure food law, one of the most wholesome and beneficent acts of legislation that has been bestowed upon the American people since the abolition of slavery.

I might remind you here that it is not necessary for all, or even a majority of those engaged in a business to act dishonestly, in order to bring about its demoralization. There is a strong tendency for the entire body to work down toward its lower standards. The great body of those engaged in irregular practices are themselves disgusted with their conditions, and perhaps, after all, the most important effect of the purification process now going on is the relief of a great body of honest and honorable young employees from the sickening and deadly influence of being compelled, day after day, year in and year out, to do things against which their consciences revolt.

* From a lecture delivered June 6, 1908, at the New York Botanical Garden. The lecturer, after quoting numerous publications on the subject of food and drug adulterations, deplored the disposition of many writers to give a sensational aspect to the subject, and of others to minimize its seriousness. Although it was not a part of his present duty to discuss the extent to which the adulteration of foods and drugs is practiced, he would state, from intimate personal knowledge, that there is enough of it to demand systematic, sustained and powerful measures for its repression and control.

It must be noted that two fundamental objects are sought in the administration of our present food and drugs law. The first is to save the purchaser from getting something which is either positively injurious, or which lacks the value to him which it should possess. There is no real difference of opinion as to the propriety of carrying on this part of the campaign. The second is to exclude what is known as the "intent to deceive," even though such deception does not result in any injury to the purchaser; even though it might perhaps confer a greater material benefit upon him than if the deception had not been practiced. To the unthinking mind, the last mentioned offense is apt to be lightly regarded and it is against its suppression that the chief activity of commercial critics has been directed. To the moralist, however, this offence is rightly regarded as worse by far than the mere infliction of some material injury. It is here that the great contest is being waged at the present time. Some influential authorities under the federal government are being misled into winking at, and in some cases openly sustaining, the most flagrant acts of deception, while others are stoutly contending that this feature of the law is deserving of the most earnest support.

I desire specially, before leaving this subject, to bring forcibly to your attention the fact that there is in operation such a powerful, systematic and sustained attempt at improvement as I have referred to; that its methods of investigation are as reliable as its motives are sincere, and that when it delivers an opinion to you, you are justified, in the main, in accepting the same as sound, in spite of any protestations to the contrary by those who are either self-interested, or irresponsible and ignorant of the facts. This is not saying that mistakes cannot occur, but in so far as you yourselves lack information, it is necessary that you should trust in some one, and I would urge you to give your confidence and support to a movement that is being most intelligently and conscientiously carried on.

Reminding you that, as an institution, our interest in this subject is purely botanical, I will refer to three methods for determining the purity and quality of our foods and drugs. The first is that of practical trial, foods being supplied to animals and the nutritive results observed and recorded, or medicines being so administered and their physiological and therapeutic effects observed by trained experimenters, delicate apparatus often being employed for the purpose. This method is manifestly very difficult, if it is to be made at all certain ; so much so that its very practicability is only now beginning to be generally acknowledged.

The second method is that of quantitative chemical analysis or assaying. This method is accurate and reliable, but the possible field of its application, especially in relation to vegetable drugs and medicines, is quite limited in the present state of our knowledge.

The third method is the examination of the physical characters of the drug, especially its structure. This is the natural method of examining the article when entire. When it comes to us in the form of a fine powder, as it usually does, its examination can be conducted only by the aid of the microscope. The possibility of identifying the minute elements of these powders has been to a great extent doubted, even by many scientific people who should know better. Only a week ago a very prominent pharmacist acquaintance expressed surprise at my reference to this work, saying that he supposed that as yet it was mere theory.

We have only to reflect that each of the cellular elements composing the plant is just as much a complete individual as is the whole plant and that it has its own characteristic structure and life history. It will not then surprise us to be told that many of the cells of plants, properly magnified, can be recognized with as much certainty as can other natural objects.

It is true that until very recently little could be done in this direction, but this fact was due wholly to lack of knowledge of methods and substances. Within the last few years, thanks to the services of Kraemer, Schneider, Jelliffe, Nelson, Mansfield and others in this country, and many foreign workers, the minute structure of a large part of our drugs has been made known to us. I do not claim to be one of the leaders in this work, but I have followed the investigations of these men with the greatest interest and profit, and I have endeavored to bring together this afternoon a number of cases illustrating the importance of the work, the certainty of its results, and the nature of the methods by which it is carried on.

One of the very first things for which the pharmacognosist looks in identifying a drug powder or fragment is the presence or absence of starch grains, and their peculiarities, if present. Starch is probably in most cases the first compound formed by the leaves of the plant out of carbon dioxide and water, and most plants store it in the form of granules. These granules have a distinct plan of structure, which differs in different plants. The size and form are also characteristic of the plant producing them. I exhibit here a very instructive illustration of a group of starch grains, taken from Kraemer's work. Observe the very large grains of potato and arrow-root, with their very distinct rings. The hilum is near the end in both, but in the second it is fissured. Wheat starch has a rather small grain, distinguished by its lenticular shape, very well seen in the granules which present their edges to view, and by the central hilum. Corn starch is peculiar in its angular outline and its fissured central hilum. Curcuma starch is very beautifully formed and marked, although it reminds one of the appearance of some bugs. All starch grains must be measured, the upper limits of size being fairly constant. Their occurrence singly or in groups is also significant of their identity. In this picture of Colchicum corm you see them mostly grouped in threes and fours, and having a very peculiar hilum.

This next picture illustrates potato starch grains altered by moist heat. It is not unusual for a dishonest drug miller to grind up with a good drug a portion of exhausted material, from which medicine has already been made. Such material is first put into a still to drive off its alcohol, in which process it is steamed. By this steaming it is swollen and its shape altered and it loses its characteristic markings.

In this specimen of *Inula*, or Elecampane, you look in vain for starch-grains. It belongs to that largest of all plant families, the daisy family, which forms none. This family yields a great number of drugs and you at once see that if adulterated with a drug from another plant, we are very likely indeed to find starch grains, which at once exposes the fraud. You do see a reserve food material in these cells, but it is inulin, a substance which approaches nearer to sugar than starch does.

The drug *Lycopodium*, here shown, consists of the spores of various species of that genus, especially *L. clavatum*. The peasants gather and store it in flour bags, so that cereal starches are apt to occur in it. Advantage is often taken of this fact to fraudulently add such substances. In this case we must be guided in our judgment by the amount of starch present.

Another article exceedingly abundant in the cells of plants is calcium oxalate, which occurs in crystals of various beautiful forms, a number of which are here shown. The needle-shaped crystals occur in squill and many other drugs of the lily family. The rosette masses are common in *Viburnum*, the doubly pointed prisms in soap-bark and the loose masses resembling sand in belladonna leaves.

Belladonna root is a drug that is used on an enormous scale in this country, being imported from Europe. During the past year nearly all that was imported contained an admixture of poke-root. The properties of the two are widely distinct, and the adulteration was a serious one. The two roots as presented in this picture are of very different appearance, but when mixed in small pieces through the bales the poke can very easily go undetected. When powdered, there is no general difference in the appearance; but viewed with the microscope, the pokeroot shows numerous needle-shaped crystals which are entirely wanting in the belladonna. This poke is the species that occurs in Europe. In the one of this vicinity, these crystals are much larger, so that we can actually determine whether the adulteration took place in Europe or in this country.

These illustrations indicate the use that is made not only of these but of numerous other contents of cells in detecting adulteration. The cells themselves are often indicative of the same condition. One of the most important classes of such cells is the stone-cell. This variety of cell is usually rather short, and consists almost wholly of wall, that is, it has a very small cavity. The wall is hard and heavy, and this sort of cell is used by the plant, as builders use stone or brick, in forming strong and impenetrable walls. Hence we find it largely composing shells of nuts and the endocarps of fruits. These, being waste products, are for sale at very low prices and in abundant quantity, so that they are favorite adulterating substances. Olive pits are very largely ground up for this purpose, and their stone-cells are here shown. You will at once see how readily these could be detected in this powdered aconite root. They are very largely used in ground black pepper.

Those of cocoanut shells are very similar, as here shown, but they look somewhat different after the shell has been roasted. Both the raw and roasted article have been traded in to the extent of several car-loads at a single sale. They have been used with especial frequency for the adulteration of chocolate, the pure powder of which is here shown.

One of the most interesting of these stone-cells is that in birch-bark. After the aromatic oil has been distilled from birch to be sold under the name of oil of wintergreen, the residue is useless, and it is not infrequently added to powdered drugs. It is not only of peculiar shape, but many of the cells have a bright red spot, here of course showing black. I have recently found it in powdered ipecac. This is a peculiarly villainous form of adulteration, because, as most of you know, ipecac is frequently our sole reliance in saving the life of a child attacked with croup.

One of the most interesting cases of adulteration is that of pinkroot (*Spigelia*) with the root of *Ruellia*, which possesses none of the properties of the former. So common is this adulteration that I have almost never seen a lot that was both genuine and pure. So positive was I that the published descriptions and pictures of the powder of *Spigelia* were incorrect, that I took some roots of each from flowering plants, and gave them to my associate, Dr. Mansfield, for study. It turns out that not one of the many descriptions and pictures has failed to describe or illustrate the false for the genuine. Here is one of these pictures, and there is scarcely an element in it that does not pertain to the *Ruellia*.

Closely related to stone-cells are the fibers of plants, the long, thick-walled cells that give strength and toughness to woods and barks. It often happens that a food or drug that contains no fibers is adulterated with some article that does, and the fact is at once shown by the microscope. Capsicum or cayenne pepper should be made by grinding up peppers from which the stems and hulls (calyx) have been removed. When a careless or greedy miller violates this rule, these fibers tell the story.

Gentian, although a large root, is another drug that contains no fiber, as you see by this picture, yet I have last year condemned two very large lots which consisted to the extent of 50 per cent. of coarse fiber, perhaps old bags or ropes ground up.

One of the most valuable drugs at the present day, from both a pecuniary and medicinal point of view, is the root of *Hydrastis* or golden seal. Its price, about $2.00 per pound, makes it a favorite article for adulteration, since a very handsome profit can be made by adding only 10 per cent. or even 5 per cent. of cheap adulterant, an amount that may readily pass undetected. As you can see, there are no fibers in it, and almost everything that would probably be used for its adulteration, contains them. Nevertheless, I am satisfied that we know little as yet about the adulteratian of this drug, and that we are constantly accepting as pure lots that are adulterated. The subject is one most in need of investigation. This picture is of great interest, since it displays two crystals that you would think, after previous explanations, consist of calcium oxalate. They are in reality the sulphates of two important alkaloids, hydrastine and berberine, which occur in this drug.

We have now given considerable attention to the inner elements of the plant; let us consider some of the externals. Many years ago I was deeply impressed by the publication by one of our scientific directors, Mr. Charles F. Cox, of a valuable paper on a subject then little known, the characteristic features of plant hairs, or trichomes. I remember with what surprise I read his statement that in many cases the family of a plant could be determined by examining its hairs. Since then I have come to see these trichomes used for the unerring determination, not of families merely, but of species of plants in the form of dust powders.

One of the interesting oriental drugs is *Kamala*, consisting of the glands and hairs abraded from the surface of a fruit related to the castor oil plant. These glands and hairs are very well known, but I here show you an illustration of them.

I present here an illustration of the henbane leaf, one of our most important drugs, in order that you may note the great variety of glandular hairs which it bears. The subject of this drug and its adulteration is one of the most interesting that presents itself to us at the present time. The drug is extremely variable in its percentage of alkaloid, it being most common for it to fail to contain the required one twelfth of 1 per cent. There is another species of *Hyoscyamus* (*H. muticus*), growing in Egypt, and forming an immense spreading herb often weighing more than half a hundred weight. It can be collected in great quantity and very cheaply. This species often contains from ten to fifteen times as much alkaloid as the other. Since this alkaloid is not of the same kind, and has not the same medicinal properties as that of the other, there should be no substitution. As a matter of fact, however, it has been quite common during the past year to add a quantity of this spurious article to an inferior henbane so as to bring up its alkaloidal percentage. The article is revealed by its large stellate hairs, and the peculiar convoluted walls of its cells, here exhibited.

The hairs of *Digitalis*, or fox-glove, look somewhat like those of henbane, though it is not difficult to distinguish them. I have this season condemned a lot of powdered digitalis because it contained the hairs here shown, with their surfaces thickly papillose or warty; showing the presence of *Stramonium*. Desirous of checking my work, I gave some of it, as digitalis, to our chemist, asking him to determine its constituents. He reported that it contained a mydriatic alkaloid, which is just what stramonium contains. Fox-glove, on the other hand, contains glucosides, but no alkaloid.

In the same lot of powdered drugs which contained the digitalis last mentioned, there was some stramonium, so labeled, which contained such hairs as are here shown and which indicate chestnut leaves. It is very rarely that we encounter them in this stellate form, since the powdering process detaches the hairs individually, or in twos or threes, from the rosette. The chestnut leaf has been a favorite artiticle for use in adulterating other powdered leaves.

We come next to one of the most interesting cases of adulteration, or rather of substitution, that I have ever encountered. The complete disentanglement of what has become a system of error, which I shall shortly undertake, will carry us back nearly two centuries, to the early history of Peru. Suffice it to say here that the two plants shown side by side have been collected under the name of Matico. Surely no botanist present will object to my claims that they are distinct species, one *Piper angustifolium*, the other *P. Mandonii*. The former is the genuine drug, the latter the substitute. Yet, different as these are, my decision has been criticised in various places. I am told that botanists at the National Herbarium have done so, and an official scientific body in Germany has given the foreign shipper a certificate that the last named drug is genuine. Mansfield's examination shows the hairs of the genuine, as here shown, single and weak, with thin walls. In the spurious species, these hairs are stellate and have the walls so greatly thickened as to almost obliterate the lumen. Upon incineration these leaves yield more than double the amount of ash of the other, and this ash contains two or three times the percentage of silica. Its medicinal properties are much weaker.

The picture of *Aspidium*, or male fern, here presented is unfortunately not characteristic. Among other things, this drug is characterized by the presence of glandular hairs, which, instead of growing outward upon the surface, grow inward into the intercellular spaces. This drug should contain no fibers, but its powder is frequently loaded with them. Male fern, as a remedy for tape-worms, has come to be regarded by physicians as a very unreliable medicine. I believe, on the contrary, that it is one of the most reliable, and that its bad reputation is due almost wholly to the enormous extent to which the drug has been adulterated.

H. H. Rusby.

THE LACE-BARK TREE.

Among the many interesting trees of the island of Jamaica, there is one of peculiar interest on account of the unusual character of its inner bark, which, when freed from the outer confining bark and spread out, much resembles linen lace, hence its popu-

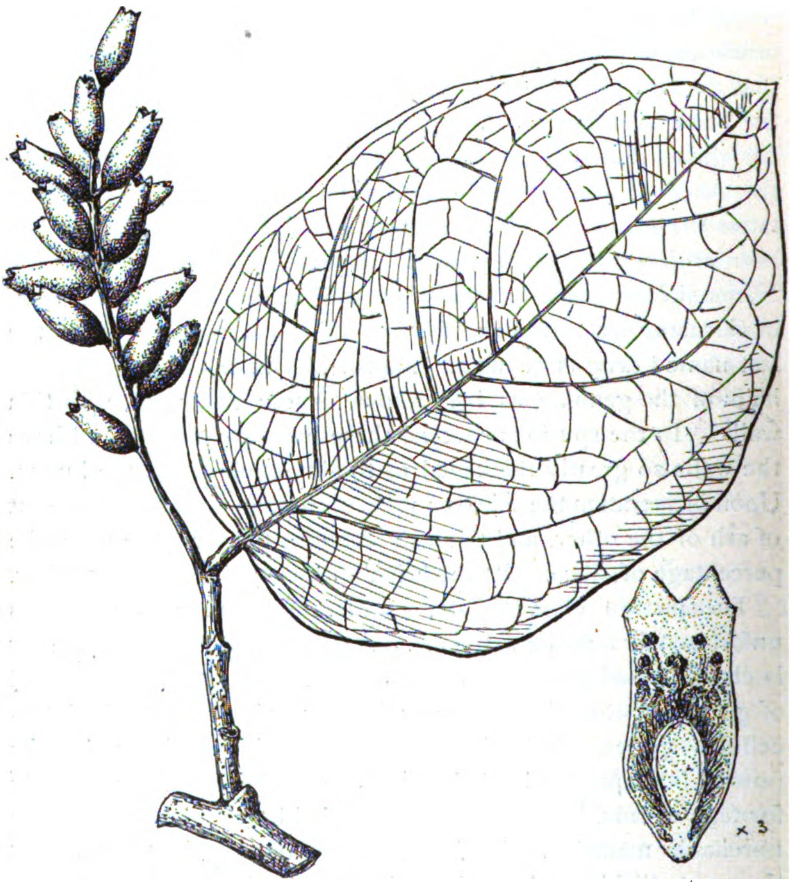


FIG. 14. Flowering branch of the lace-bark tree, *Lagetta Lagetto* (Sw.)

lar and appropriate name of the lace-bark tree. This tree is commonly found in the central and western parts of the island, and is also said to occur in Haïti. It is of a rather straggling habit, and in its native wilds attains a height of twenty to thirty feet. Its ovate leaves are of a shining light-green, and very attractive. The flowers are fleshy, of a creamy-white color, and borne in long slender spike-like racemes. The tree is a relative of the leatherwood or moosewood, *Dirca palustris*, of our north-eastern woods, belonging to the Thymeleaceae, or mezereon family. In the public conservatories, in houses 4 and 7, will be found specimens of this interesting tree. One of these has flowered for the first time, and the accompanying illustration was drawn from flowers secured from this specimen.

This tree is known to botanists as *Lagetta lintearia*, a name given to it in 1789 by Lamarck, who, recognizing its differences from the old genus *Daphne*, in which it had first been placed, raised it to the dignity of a genus. It was first called *Daphne Lagetto* by Swartz, in 1788. As *Lagetto* is the oldest specific name for this plant, it must be adopted, and so to botanists this tree must be known in future as **Lagetta Lagetto** (Sw.).

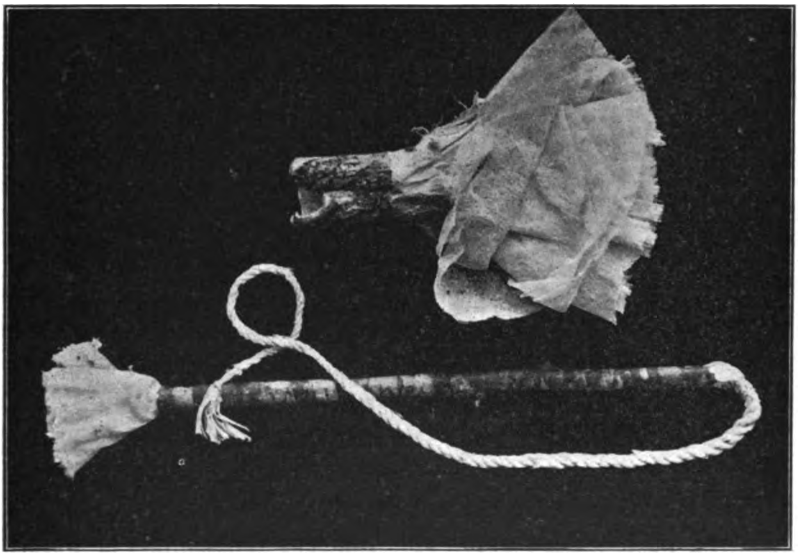


FIG. 15. The upper figure shows a section of wood with part of the outer bark removed, exhibiting the lace-like character of the inner bark; the lower figure represents a whip made from this tree.

The restricted distribution of this tree makes it an object of interest, but its peculiar interest, as was stated above, lies in its inner bark, which has given it the popular name of lack-bark, and which perhaps caused Lamarck to give it the specific name of "lintearia," meaning "of or belonging to linen." This inner bark is made up of fibers arranged in several layers, which may be stretched apart into a loose fabric. This is well shown in the upper figure of the second illustration accompanying this article.

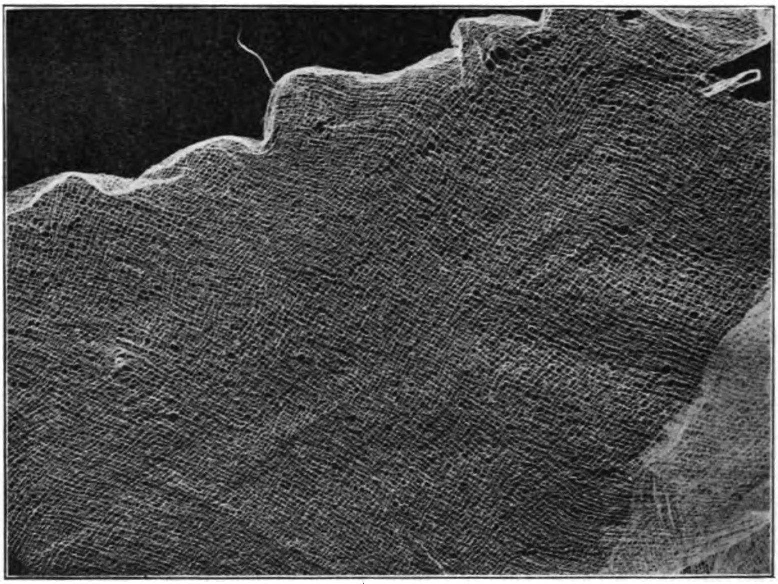


FIG. 16. One of the layers of the inner bark, showing its lace-like texture.

It hardly seems possible that all of this fluffy mass could have once been confined within the outer bark, shown in the other end of the figure. The lace-like character of the inner bark may be seen in the third illustration. In former times, and even now to a less extent, the people employed this bark in making capes, ruffs, bonnets, and even entire lace suits. Its yellowish tinge is removed by bleaching in the sun, frequent applications of water being given. It has, unfortunately, had other uses than the adornment of the person, for during the days of slavery it was manufactured into whips which were used in beating the negro slaves. A whip of this kind is shown in the lower figure of the second illustration, and is made by removing the woody tissue from the center of the stick for a portion of its length, leaving only the bark for the lash. This bark was also formerly largely used by the Spaniards in the manufacture of rope, and it is said that the Indians employed it for a great variety of purposes.

The first introduction of this tree into cultivation seems to have been at the Royal Gardens, Kew, throu h plants secured by Capt. William Bligh in 1793. These soon died, however, before flowering. The next attempt to introduce it was made about 1844, when Mr. Wilson, curator of the botanical gardens at Bath, Jamaica, sent seeds and young plants to the same institution. Several of the plants thus secured flourished, and one of them in 1849, when eight to ten feet tall, produced flowers and fruit. It seems to be extremely rare in cultivation, at least in this country, and no mention is made of it by Bailey in his Cyclopedia of American Horticulture. I find no record of its having flowered before in the United States.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT.

During April and May about ten thousand school children, accompanied by their teachers, visited the Garden as a regular school exercise. Suitable lectures and demonstrations were arranged for most of them.

A very valuable collection of Philippine fungi, consisting of between six and seven hundred packets, has recently been sent in by the Bureau of Science, Manila, for determination. Most of these are duplicate specimens and will become permanent additions to the Garden herbarium.

The unusually high rainfall of May, 7.36 inches, has caused the grass on the lawns to grow so rapidly during the month that it has taxed all available men and horses to keep the lawns properly mowed, and certain portions of the lawn area grew very high before they could be reached with the machines.

A joint meeting of the Horticultural Society of New York and the American Rose Society was held at the Garden June 10. An exhibition of lantern slides was given by Mr. Leonard Barron, showing types of roses for various purposes. The usual exhibition was held June 10 and 11.

Volume 22, part 3, of North American Flora appeared June 12, 1908. This part contains descriptions of the Grossulariaceae by F. V. Coville and N. L. Britton; the Platanaceae by H. A. Gleason; the Crossosomataceae by J. K. Small; the Connaraceae by N. L. Britton; the Calycanthaceae by C. L. Pollard; and the Rosaceae, in part, by P. A. Rydberg.

An important addition to the literature of the fleshy fungi has recently been made by Miss Gertrude Burlingham, now of the State Normal School, Trenton, N. J., who was a student at the Garden and Columbia University from 1905 to 1908, during which time she made an exhaustive study of the Lactariae, or gill-fungi having a milky juice. The results of her studies appeared May 26 as a memoir of the Torrey Botanical Club (**14**: 1–109. *f. 1–15.* 1908). The descriptions and notes are very complete, and the illustrations, from photographs by the author, are excellent. A feature of great value to collectors is a condensed description of each species when fresh with distinguishing characters to be used in the field. Seventy-one species are recognized in the United States, six of these being described as new.

The process of enriching soil by the growth of crimson clover is being tried this spring on about half an acre of land immediately behind the museum building, and the growth of the crop may readily be watched, the field being in full view from the windows of the systematic museum. The clover seed was sown May 14, the plantlets began to appear above ground on May 20, and the first foliage leaves were developed by May 30. An examination of the little plants on June 2, when they were about an inch high, showed the roots already provided with tubercles containing the organisms which concentrate nitrogen. A complete account of the development of the plant and of the cost of the work on this field will be published in a subsequent number of the JOURNAL.

Construction work is going forward on the fence along the southern boundary of the Garden from the Elevated Railway Station to the Southern Boulevard, on the property line adjoining the land of Fordham University, under a contract of the Park Department with Guidone & Galardi. The rubble stone base is now nearly completed, many of the piers built, and it is expected that the iron fence will be in place and the work finished by midsummer. This handsome fence replaces an old stone wall, much of which was used in the foundations for the new structure; its completion will make it possible to plant the strip between the path near this boundary line and the fence, in the autumn, after a small amount of necessary grading shall have been done.

Meteorology for May. — The total precipitation recorded for May was 7.36 inches. Maximum temperatures were recorded of 69° on the 5th, 89° on the 17th, 87° on the 24th, and 90° on the 27th; also minimum temperatures of 41.5° on the 5th, 48° on the 13th, 50.5° on the 19th, and 53.5° on the 29th.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

200 herbarium specimens from British America. (By exchange with the Geological Survey of Canada.)

2 museum specimens of cocaine hydrochloride. (Given by Messrs. Schieffelin & Company.)

6 specimens of mosses from Cuba. (By exchange with Professor C. F. Baker.)

40 specimens "American Hepaticae," nos. 1–40. (Given by Miss C. C. Haynes.)

1 specimen of fern from Ontario. (Given by Mr. J. H. Faull.)

1 specimen for the food collection. (Given by Dr. H. H. Rusby.)

1 specimen of rust from Nevada. (Given by Dr. P. B. Kennedy.)

1 specimen of *Polygonum aviculare* for the drug collection. (Given by Dr. H H. Rusby.)

3 specimens of mosses from Long Island. (Given by Mrs. N. L. Britton.)

15 specimens of mosses from Central and North America. (By exchange with Dr. J. Röll.)

2 specimens of mosses from Connecticut. (Given by Miss Annie Lorenz.)

97 specimens of ferns from Jamaica. (Collected by Mr. W. Harris.)

2 specimens of ericaceous plants from Nantucket, Massachusetts. (Given by Mr. E. P. Bicknell.)

2 specimens of flowering plants from Long Island. (Given by Mrs. N. L. Britton.)

546 specimens of flowering plants from Guatemala. (Collected by Professor W. A. Kellerman.)

600 specimens of fungi from the Philippine Islands. (In exchange with the Bureau of Science through Mr. E. D. Merrill, botanist.)

PLANTS AND SEEDS.

1 plant of *Cereus flagelliformis*. (Given by Mrs. J. Dorr.)

1 plant of *Nephrolepis exaltata bostoniensis*. (Given by Messrs. F. R. Pierson & Co.)

1 plant of *Sedum* from Mexico. (Given by Prof. F. E. Lloyd.)

4 succulent plants for the conservatories. (By exchange with Mr. Frank Weinberg.)

1 plant of *Ficus lutescens*. (By exchange with the N. Y. Zoölogical Society.)

311 hardy evergreen plants, mainly conifers. (Given by Mr. Lowell M. Palmer.)

485 hardy shrubs and trees. (Purchased.)

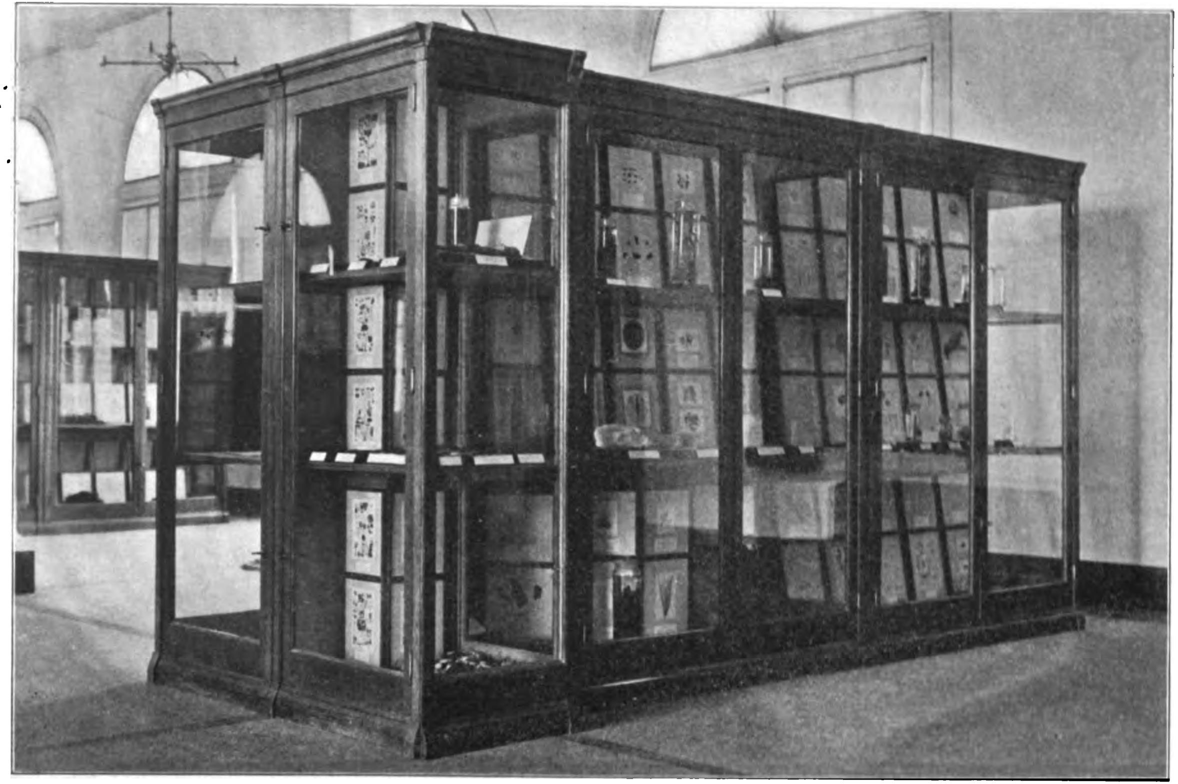
17 packets of seed from the Bahamas. (Collected by Mr. Percy Wilson.)

2 packets of seed from Jamaica. (Collected by Dr. N. L. Britton.)

4 packets of seed from the western United States. (Given by Mr. Wilhelm Miller.)

1 packet of seed from South Africa. (Given by Dr. H. H. Rusby.)

3 plants derived from seeds from various sources.



The Museum Cases of Algae.

JOURNAL

OF

The New York Botanical Garden

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THE COLLECTIONS OF ALGAE.

Accounts of the collections of the fungi and of the mosses and hepatics, in the possession of the New York Botanical Garden, have already been published in the present volume of the JOURNAL. A description of "The Museum Exhibit of Seaweeds," by the present writer, appeared in the JOURNAL for March, 1904, but since that time there have been considerable additions to the collections of the seaweeds and their fresh-water relatives, in both museum and herbarium, so that some further account of them is perhaps now justifiable.

As is the case with the fungi and mosses, the herbarium of Columbia University, deposited with the Garden in accordance with the terms of an agreement made in 1896, furnishes the nucleus of the collections of algae at the Garden, although this original element is now largely overshadowed by the accessions made on the part of the Garden since the merging of the two institutions. The collections of algae, however, have never received any increment comparable in magnitude and historical importance with that of the fungi through the purchase of the Ellis collection or that of the mosses and Hepaticae through the purchase of the Mitten herbarium. Nevertheless, the collections in this department have been rather notably increased during the past decade by the purchase or gift of several herbaria, by exchange with various collectors and institutions, and by special expeditions sent out by the Garden to Bermuda, Florida, the West Indies, Nova Scotia, and Newfoundland.

The older collections, belonging to Columbia University, include a number of specimens of historical interest, sent to Professor John Torrey by Dr. Jacob Whitman Bailey, who was for many years a distinguished teacher of the natural sciences at the United States Military Academy at West Point, by the elder

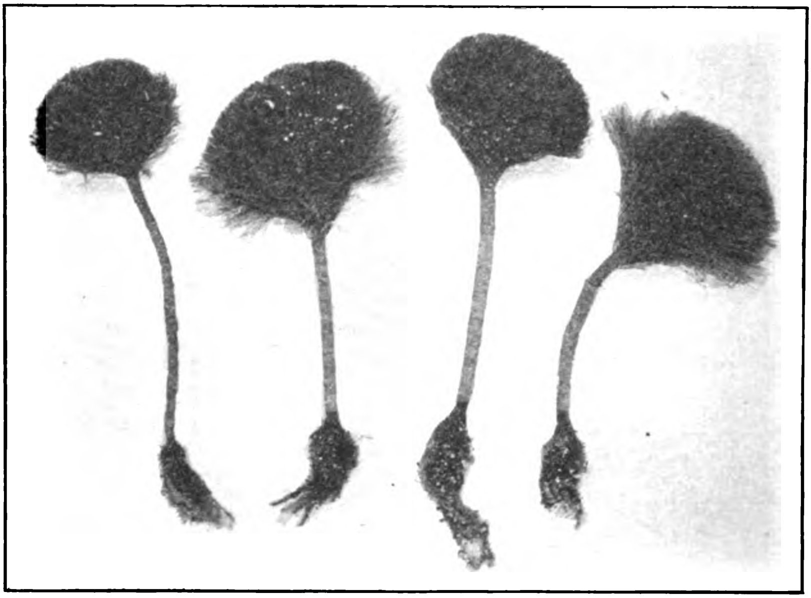


FIG. 17. The Merman's Shaving-brush (*Penicillus capitatus* Lamarck). From Bermuda. One half natural size.

Agardh of Lund, Sweden, one of the founders of modern phycological science, and by several others among the well-known students and collectors of the algae during the early and middle portions of the last century.

If, as is the usual fashion at the present day, the Characeae or stoneworts are to be included among the algae, the first notable accession to our collections in this department after the consolidation of the herbaria of Columbia University and the Garden was the donation by Dr. Timothy Field Allen, in 1901, of his collections of Characeae. Dr. Allen was for many years the leading American student of this group of plants and the collection

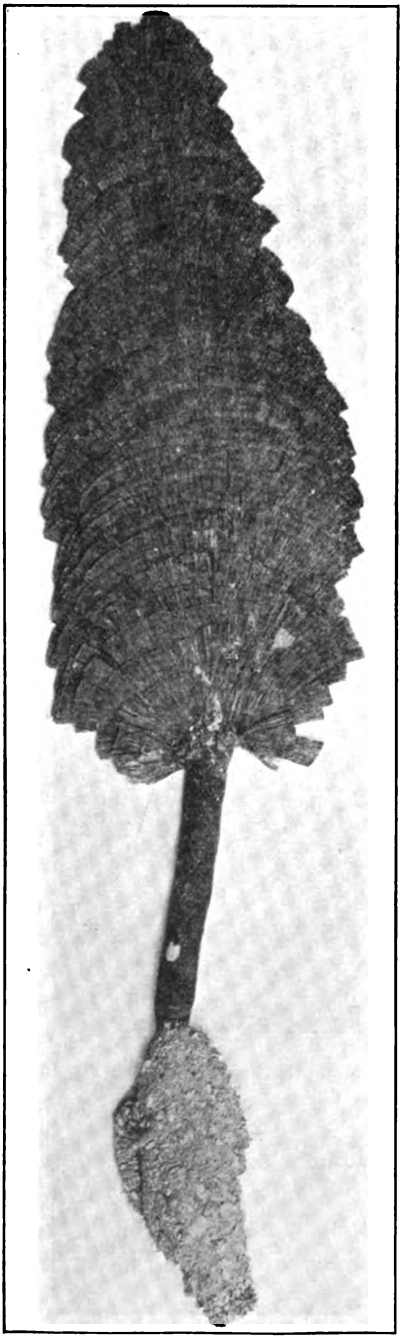


FIG. 18. *Rhipocephalus Phoenix* (Ell. & Soland.) Kütz. From the Bahamas. Natural size.

that he brought together is unsurpassed in the United States and probably by only three or four in the world at large. It contained nearly 4,000 sheets which have been incorporated in the Garden herbarium and about twice as many more which have been distributed as duplicates. A more detailed account of the Allen collection was published in the JOURNAL for April, 1901.

The first of the collections of algae, of any considerable size, secured by the Garden through purchase, was that of Rev. George W. Perry, who was, at one time, state geologist of Vermont. This herbarium, bought in 1902, consisted of about 1,400 specimens of seaweeds collected chiefly in Massachusetts or obtained by exchange from California, Europe, and Australia. Another algal herbarium, containing nearly 2,500 specimens, purchased in the same year, was that of Mr.

Horace Averill, of Brooklyn. This was especially rich in the local forms and included also many species obtained by exchange from other parts of the world. A third collection of algae, chiefly marine, purchased by the Garden, was that brought together by the late Colonel Nicolas Pike, who communicated to Professor W.

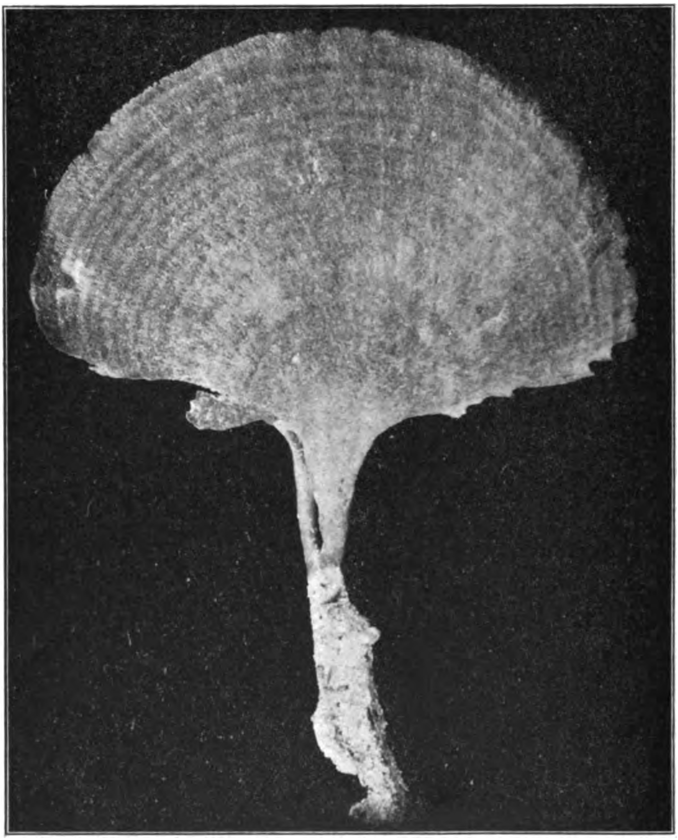


FIG. 19. *Udotea conglutinata* (Ell. & Soland.) Lamour. From the Bahamas. Eight sevenths natural size.

H. Harvey many of the specimens upon which the Nereis Boreali-Americana was based. The Pike collection consisted of a few more than 3,000 specimens. Colonel Pike was United States Consul at Oporto, Portugal, for about ten years, and later, for an equal period, held a similar position in Mauritius. He made extensive collections of algae at both of these points and his herbarium was particularly rich in Mauritian material. In 1904, the algal collections of Dr. C. L. Anderson, of Santa Cruz, California, numbering about 4,000 specimens, came to the Garden through purchase. Dr. Anderson has been an enthusiastic collector of the marine algae during a long residence in Santa Cruz, and being for many years the leading student of this group of plants on our Pacific Coast, he received for determination many specimens from other collectors in that region, and as he had also exchanged extensively with collectors in the eastern states and in Europe, his herbarium brought elements of much value to the Garden's collections.

But the chief source of the increase in the Garden's algal herbarium in recent years has been from special expeditions sent into the field for the purpose of making collections. In 1900, the writer was enabled through a grant from the department of botany of Columbia University and one from the John Strong Newberry Fund to make collections and studies of the marine algae in Bermuda, on Marthas Vineyard, Mass., and on the coast of Maine. On behalf of the Garden, in 1901, an expedition was made to Nova Scotia and Newfoundland; in 1902, to Florida; in 1903, to Porto Rico; in 1904, to Florida and the Bahama Islands; in 1905, to the Bahama Islands; in 1906, to Porto Rico; in 1906–'07, to Jamaica; and in 1907, to the Bahama and Caicos Islands. These expeditions have resulted in bringing together about 35,000 dried specimens of marine algae, as specimens are commonly counted. Many of these still await critical study and are yet to be incorporated in the herbarium proper. Probably two thirds of them will be used as duplicates for exchange or for distribution to other institutions. The dried specimens are supplemented by a large amount of material preserved with the aid of formaldehyde, etc., such material being, in case of many of the species, very desirable or even essential for showing the natural form and finer details of structure. These fluid-preserved specimens are also freely used in the exhibits in the show-cases of the public museum.

In addition to the specimens obtained by the Garden expeditions or by purchase, many have reached our herbarium in the past few years through exchanges. American (and sometimes foreign) material has been received in this way from W. G. Farlow, F. S. Collins, W. A. Setchell, D. A. Saunders, J. Macoun, W. D. Hoyt, and others; Japanese specimens from K. Okamura and S. Yamanouchi; New Zealand specimens from R. M. Laing;

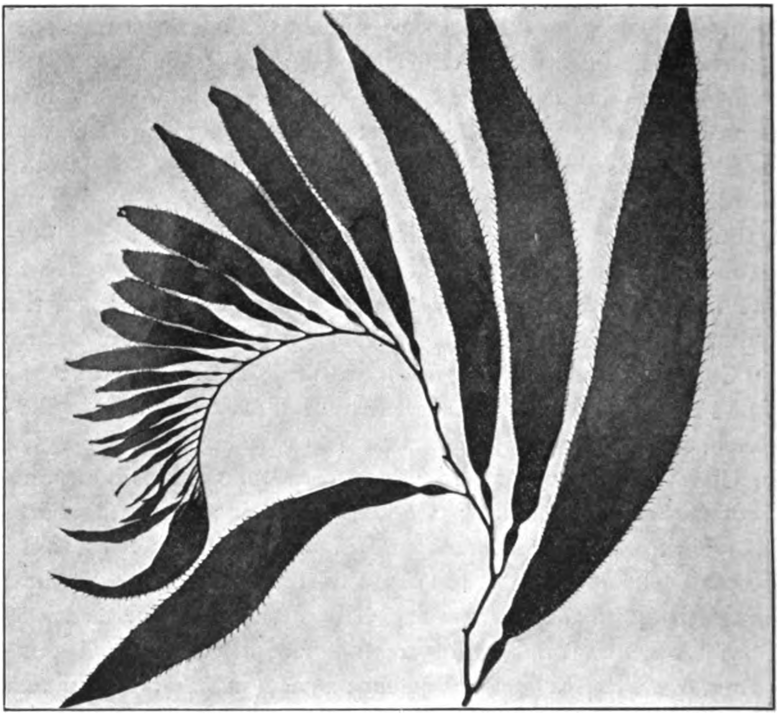


FIG. 20. Growing apex of the Great Kelp [*Macrocystis pyrifera* (Turn.) Ag.]. From a Californian specimen. About one third natural size. This plant is said to attain a length of several hundred feet.

material from Denmark, Iceland, Greenland, the Faeroes, and the Danish West Indies from F. Borgesen; Barbados specimens from A. Vickers; Ceylon specimens from N. Svedelius; algae from the Dutch East Indies from A. Weber-van Bosse; algae from various islands of the South Pacific from Th. Reinbold; fresh-water algae of Sweden from O. Nordstedt; Corallinaceae from M. Foslie; and there have been exchanges also with the British Museum, the Muséum d'Histoire Naturelle, of Paris, Trinity College, Dublin, the University of Lund, and other institutions. The herbarium contains, also, sets of the principal exsiccatae issued in Europe and America as well as Okamura's Algae Japonicae Exsiccatae. From the duplicates collected on

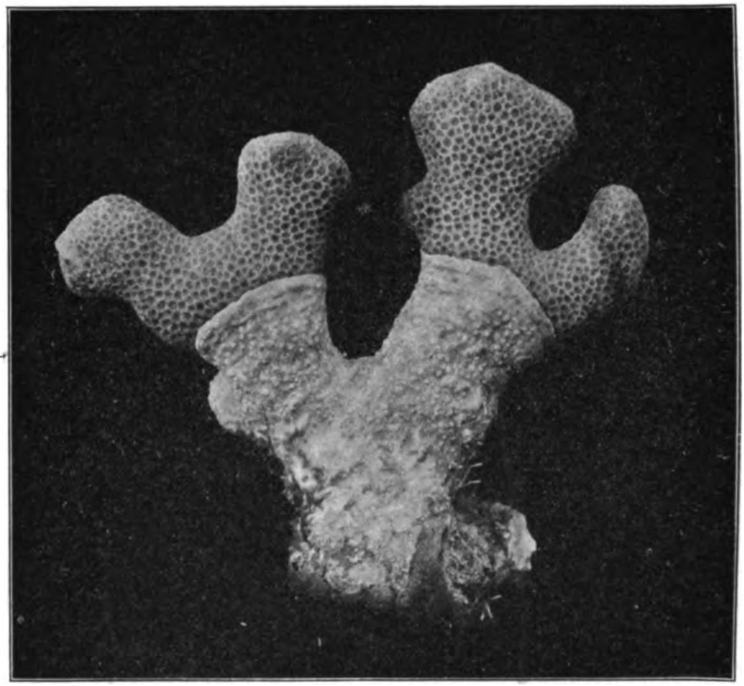


Fig. 21. A coralline alga (*Goniolithon solubile* Fosl. & Howe) encrusting and covering a living coral. From Culebra Island, Porto Rico. Natural size.

various Garden expeditions, several contributions have been made to the Phycotheca Boreali-Americana of Collins, Holden, and Setchell.

In the synoptical section of the public museum, the algae are displayed in fifteen cases and are represented at the present time by about 450 exhibits, including dried specimens, specimens in fluids, drawings, and photographs. Enlarged figures and photographs are used for showing microscopic forms and also the details of structure of selected types among the larger kinds. A few of the smaller sorts are shown under microscopes. The exhibit of tropical species and of corallines in the synoptical cases is perhaps especially noteworthy. An account of the corallines was published in the JOURNAL for July, 1905. In addition to the general systematic exhibit, the seaweeds and their relatives in the local flora are represented by specimens in swinging frames, though, at the time of writing, this feature is only partially installed, including thus far the algae of the "red" and "brown" groups and the stoneworts.

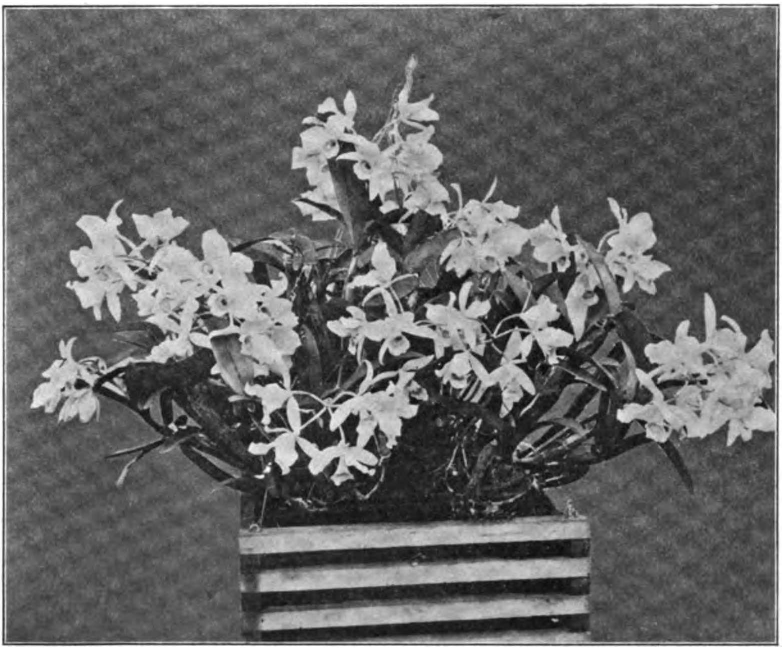
MARSHALL A. HOWE.

AN UNUSUAL SPECIMEN OF THE "FLOR DE SAN SEBASTIAN."

The plant from which the accompanying illustration was made was secured by Mr. W. R. Maxon, who made explorations for the New York Botanical Garden in Costa Rica in the early part of 1906. *Cattleya Skinneri*, of which this plant is an unusually fine specimen, is said to occur from southern Mexico to Costa Rica, and has even been reported from the island of Trinidad. It was originally found in Guatemala, where it was discovered many years ago by Mr. Skinner, in whose honor it is named, and was said by that gentleman to be found almost exclusively in the warmer parts of the country. It is known there as "Flor de San Sebastian," and is eagerly sought for by the people as an ornament for the shrines of their favorite saints. It is not obtained, however, without great difficulty, for it is said to grow in the tops of the highest trees in the forests, a habit which makes it very hard to find and harder to collect, unless the tree on which it grows happens to be uprooted by a storm.

This use of the plant for religious decoration might well be appreciated by one who had seen in full flower, in the public conservatories, this large plant brought back by Mr. Maxon. Imagine a plant with a spread of about three feet bearing in great profusion large masses of flowers of a deep rose-purple. At the height of its perfection, about the middle of May, this plant bore twenty-two flower clusters, each cluster containing from four to eight flowers.

Mr. Maxon secured the plant in a garden at Cartago. Upon its arrival here it was placed in a sunny position near the roof in a house of medium temperature and humidity, a treatment to which it responded readily as the above record of its flowering will show.



This *Cattleya* is closely related to *C. Bowringiana*, a native of Honduras, which differs in being of larger growth, with flowers of a somewhat different color, and especially in its time of flowering, which is in the fall instead of in the spring.

The genus *Cattleya* was named by Lindley in honor of Mr. Cattley, a great lover and successful cultivator of these plants in the early part of the nineteenth century. It is distributed mainly from southern Mexico to Brazil, and is represented by about twenty species. It is the various species of this genus which furnish the greater part of the large showy orchids so much used for decorative purposes. As the species vary in their time of flowering, it is possible, by judicious selection, to have some of these showy flowers in evidence at all times of the year.

GEORGE V. NASH.

NOTES, NEWS AND COMMENT.

Dr. N. L. Britton attended the special summer meeting of the American Association for the Advancement of Science at Hanover, New Hampshire, and the annual botanical field "symposium" at Georgetown, Delaware.

Professor G. W. Wilson, of Upper Iowa University, Fayette, Iowa, has been assigned a research scholarship at the Garden for two months, beginning July 1.

Dr. W. A. Murrill visited the State Museum at Albany in June to examine the collection of fungi of the family Boletaceae, which probably contains more original specimens than any other collection of its kind in America.

Signs have been placed at the principal entrances to the hemlock grove with the following instructions: "This grove is situated near the southern limit of the region in which hemlock trees grow naturally near the coast, and its preservation is a matter of special interest. As the roots of the hemlock trees are near the surface of the ground and the soil is thin, trampling over the ground may cause the death of the trees. Visitors are therefore requested to keep to the paths and trails and to abstain from injuring the trees in any way. If this caution is not observed the use of the forest will have to be materially restricted."

Following the extremely wet weather of May, a drought of unusual duration and severity has been experienced which cannot fail to be of considerable injury to vegetation. The rainfall of June was just one inch at the Garden, and no rain has fallen during July up to the fourteenth of the month. Not alone the damage to vegetation is to be regretted, but the driveways have suffered severely. Lawns have been browned in many places, but this will not be permanent because a few inches of rain-fall will cause the grass to grow again. The injury has been particularly great to shrubs and trees planted this spring, although they have been watered as much as possible.

Meteorology for June. — The total precipitation recorded for June was 1 inch. Maximum temperatures were recorded of 86.5° on the 7th, 89.5° on the 8th, 93.5° on the 21st, 93.7° on the 22d, 92.5° on the 29th; also minimum temperatures of 44.5° on the 7th, 55.5° on the 12th, 47.5° on the 17th, and 55° on the 27th. The mean temperature for the month was 69.1°.

ACCESSIONS.

LIBRARY ACCESSIONS FROM MAY 1 TO JUNE 30, 1908.

American journal of science and arts. Vol. 37. New Haven, 1839. (Given by Dr. John Hendley Barnhart.)

APPEL, OTTO. *Beispiele zur mikroskopischen Untersuchung von Pflanzenkrankheiten.* Zweite Auflage. Berlin, 1908.

BRITTON, NATHANIEL LORD. *North American trees.* New York, 1908. (Given by the author.)

BROWN, ADDISON. *The Elgin botanic garden, its later history . . .* Lancaster, 1908. (Given by the author.)

BUIST, ROBERT. *American flower-garden directory.* Ed. 6. Philadelphia, 1854. (Given by Dr. John Hendley Barnhart.)

Charleston medical journal and review. Vols. 4–5. Charleston, 1849–50. 2 vols. (Given by Dr. John Hendley Barnhart.)

COLLETT, HENRY. *Flora simlensis.* Calcutta, 1902. (Given by Miss Anna Murray Vail.)

Commercial relations of the United States with foreign countries for the years 1880–81, 1896–97, 1900, 1902, 1903, 1906. Washington, 1883–1907. 10 vols. (Given by the Department of Commerce and Labor.)

ENGLER, HEINRICH GUSTAV ADOLPH & PRANTL, KARL ANTON EUGEN. *Die natürlichen Pflanzenfamilien.* Lieferung 1–230. Leipzig, 1887–1907.

HAGER, HERMANN. *Das Mikroskop und seine Anwendung.* Zehnte Auflage. Berlin, 1908.

HENDERSON, PETER. *Practical floriculture.* New York, 1873. (Given by Dr. John Hendley Barnhart.)

KNUTH, PAUL. *Handbook of flower pollination.* Vol. 2. Oxford, 1908.

KUPFER, ELSIE. *Studies in plant regeneration.* New York, 1907. (Deposited by the Trustees of Columbia University.)

Maryland Geological Survey. Vol. 6. Baltimore, 1906. (Given by Dr. Arthur Hollick.)

OKAMURA, KINTARO. *Icones of Japanese algae.* Vol. 1, parts 1–6. Tokyo, 1907–08.

PARDEE, R. G. *Complete manual for the cultivation of the strawberry.* Ed. 6. New York, 1856. (Given by Dr. John Hendley Barnhart.)

ROBINSON, WILLIAM. *The subtropical garden.* London, 1871. (Given by Dr. John Hendley Barnhart.)

Rural New-Yorker. Vol. 10. Rochester, 1859. (Given by Dr. John Hendley Barnhart.)

SAIDA, KŌTARO & SAKURAI, HANZABURŌ. *Catalogue of botanical specimens in the natural history department of the Imperial Museum.* Tokyo, 1891. (Given by Miss Anna Murray Vail.)

SCHULZ, GEORG E. F. *Natur-Urkunden: Pflanzen.* Berlin, 1908.

SCHULZ, GEORG E. F. *Natur-Urkunden: Pilze.* Berlin, 1908.

[SMITH, JOHN DONNELL.] *Icones plantarum centrali-americanarum.* [Baltimore, 1908.] (Given by the author.)

STRASBURGER, EDUARD ADOLF, AND OTHERS. *Text-book of botany.* Ed. 3. London, 1908.

MUSEUMS AND HERBARIUM.

50 specimens "Phycotheca Boreali-Americana," Fascicle XXX. (Distributed by Messrs. Collins, Holden, and Setchell.)

4 specimens of mosses from Connecticut. (Given by Miss Annie Lorenz.)

7 specimens of mosses from the Chiricahui Mountains, Arizona. (By exchange with Mr. J. C. Blumer.)

214 specimens "Crytopgamae Formationum Coloradensium." (Distributed by Professor Frederic E. Clements.)

220 specimens of mosses from Costa Rica and Guatemala. (Distributed by Mr. E. Levier.)

61 specimens of flowerless plants from Bermuda. (Collected by Mr. Stewardson Brown.)

4 specimens of drugs. (Given by Dr. H. H. Rusby.)

7 Syrian food products. (Given by Mr. Siyd Mikel Albestany.)

5 specimens of Chinese food products. (Given by Dr. H. H. Rusby.)

2 specimens of *Bovista pila* from Vermont. (Collected by Dr. M. A. Howe.)

1 specimen of rust from Long Island, New York. (Given by Dr. H. D. House.)

4 specimens of woody fungi for the conservatories. (Collected by Dr. W. A. Murrill.)

22 specimens of polypores from the Adirondack Mountains. (Collected by Dr. W. A. Murrill.)

112 specimens of drugs. (Given by Messrs. Merck & Company.)

100 specimens "Bryotheca Exotica." (Distributed by Mr. E. Levier.)

PLANTS AND SEEDS.

8 plants for woody nursery. (Given by Mr. H. S. Adams.)

3 cactuses from Colorado for conservatories. (Given by Mr. T. D. A. Cockerell.)

1 plant of *Arisaema Stewardsoni* for herbaceous grounds. (Collected by Mrs. E. G. Britton.)

1 plant of *Dryopteris Goldieana* × *marginalis.* (Collected by Mr. R. C. Benedict.)

38 chrysanthemums for nursery. (By exchange with the Bureau of Plant Industry.)

257 plants derived from seed from various sources.

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COLLECTING FUNGI AT BILTMORE.

Dr. N. L. Britton, Director-in-Chief.

Sir: With your permission, I accepted an invitation from Dr. C. A. Schenck, Forester of the Biltmore Estate, to spend two weeks in July at his summer home in Pisgah Forest for the purpose of studying the fungi of that region. My report on these studies is prefaced with a brief account of this interesting estate.

The estate of Mr. George W. Vanderbilt is situated in Henderson and Transylvania counties in the western part of North Carolina to the south and southwest of Asheville, a region famous for its superb climate and magnificent scenery, many of the mountains being over 5,000 ft. in height and a few, the highest in the eastern United States, attaining an elevation of nearly 7,000 ft. By far the greater part of the 130,000 acres in the estate is mountain land covered with virgin forest, the arable land being situated in the valleys of the Swannanoa and French Broad rivers near the village of Biltmore.

Biltmore House, modeled after the famous *chateaux* of the Loire, was completed nearly twenty years ago, and with its rich furnishings and splendid landscape effects that have only recently been brought to maturity, it is easily the finest country seat in America. Biltmore village, two miles from Asheville and twenty-four hours by rail from New York, has the appearance of an exceedingly neat and comfortable old English village, with houses in half-timbered style built of cement mixed with sand and pebbles from the adjacent river bottoms and molded on frames of wood and wire. Near Biltmore are the nurseries, the dairy, the swine and poultry ranges, and other adjuncts of farm life for which the estate is famous.

Mr. Vanderbilt usually spends about six months of the year at Biltmore House. He lives quietly, being devoted to literature and to the study of natural history, and his guests are usually selected on account of personal achievement rather than because of social distinction. Occasional visits are made with friends to his hunting lodge on Pisgah and to the excellent trout streams in various parts of the estate. Once a year the favored families of Asheville and vicinity are entertained together at Biltmore House; and during the Christmas holidays every family on the estate is invited there to a feast, after which each man, woman and child receives a suitable gift.

The effect of this magnificent estate on the people of western North Carolina, combining as it does the artistic and the practical, must have been very marked in the past twenty years, being no less than that of a great educational institution diffusing knowledge of facts and methods, giving employment and encouragement to many, and depending upon and developing the energy, experience and devotion of those employed.

The forest lands are in charge of Dr. C. A. Schenck, who succeeded Mr. Gifford Pinchot many years ago as forester of the estate. Forestry at Biltmore is twenty years old, the oldest of its kind on American soil. According to Dr. Schenck, the problems are totally different from those in Germany, where he received his training. Since coming to Biltmore, he has extended and elaborated the plans of Mr. Pinchot and has in many cases followed original lines of development. Lumbering operations are conducted on an extensive scale, and the denuded hills and abandoned fields near Biltmore, comprising about 2,000 acres, have been planted with a variety of useful trees, such as white pine, pitch pine, hemlock, oak, chestnut, maple, ash, yellow poplar, walnut, basswood, locust and cherry. It is possible to see in a short drive all stages of these plantations from young trees just removed from the seed beds to trees twenty years of age.

The Biltmore Forest School, organized ten years ago, is located at Biltmore from November to April, and is removed to Pisgah Forest for the remainder of the year. The forenoon of each day is regularly devoted to lectures and the afternoon to excursions for observation and the practical application of forestry methods employed on the estate. Twenty-four young men are now enrolled as students, and as many more are on the waiting list.

Pink Bed Valley, the home of the forester and the forest school from the middle of May to the first of November, is in Transylvania County, twelve miles from Pisgah Forest Station in the direction of Cold Mountain, The Balsams, and Pisgah Ridge. The valley is about eight miles long, with an elevation of 3,000 to 3,500 ft., and the surrounding ridges that completely shut it in, except at two points, reach an elevation of a thousand feet more. The forest is composed of hardwood species, chestnut, oak and tulip predominating, while pitch pine occurs sparingly on the dry ridges and white pine and hemlock along the streams. Minor hardwoods are hickory, black gum, basswood, sourwood, birch, maple, black locust, butternut, ash and Fraser's magnolia. *Rhododendron*, *Kalmia* and *Azalea* are exceedingly abundant, forming impenetrable thickets in many places, which, when in flower, are visible from a distance as pink-colored masses or "beds." *Gaylussaccia ursina* and *Vaccinium corymbosum* are also very abundant in the undergrowth. Balsam and spruce forests are found at an altitude of five to six thousand feet on summits easily reached from Pink Bed Valley.

When I reached the valley, on July 13, a season of wet weather had brought out quantities of fleshy fungi, which, with the assistance of Dr. H. D. House, were collected in abundance. Many of the thinner forms dried readily in the sun, but the more fleshy agarics and all of the *Boleti* had to be dried by artificial heat, excellent facilities being provided for this purpose by Dr. Schenck. This collection, with the notes I was able to obtain from the study of specimens in the field, should be especially valuable to the student of American fungi because of the pioneer work done in North Carolina by Schweinitz and Curtis, the former having published in 1822 a list of 1,373 species of fungi found in this state, many of them described as new, and the latter having sent nearly 2,500 species from North Carolina to Berkeley in London for determination, a large percentage of which were published as new species under the joint authorship of Berkeley and Curtis. The condition of all these early collections, even when they still exist, together with the brevity of the descriptions drawn from them originally, makes it necessary in many cases to study recent collections in order to properly understand the relationships of a given species.

Among the gill-fungi collected, species of *Lactarius*, *Russula*, *Amanita*, *Amanitopsis*, *Cortinarius*, *Marasmius*, *Collybia*, *Mycena*, *Cantharellus*, *Pleurotus*, *Crepidotus* and *Hygrophorus*, were quite common, while many other genera were represented more or less sparingly.

Lactarius volemus and *L. piperatus* were very abundant, while *L. lignyotus*, *L. fuliginosus*, *L. torminosus*, and several other species were frequently seen. *Russula* was found in various colors, white, yellow, red, olive and green, *R. emetica*, *R. foetida* and *R. virescens* being common. All of the species of *Cantharellus* usually found in the eastern United States were represented, *C. cibarius*, *C. aurantiacus* and *C. floccosus* being common. *Amanita phalloides* was rather common, varying from pure white to blackish in color, while *A. caesarea*, *A. solitaria*, *A. rubescens* and certain other species were several times collected. *Amanitopsis vaginata* and *A. farinosa* were exceedingly common. *Clitocybe laccata* was just beginning to be abundant, and *C. illudens* was found once. *Cortinarius* was represented by about six species, several of them common. *Paxillus rhodoxanthus* was very common along the roadsides and was frequently mistaken for a *Boletus*, the upper surface being very similar to certain members of this genus. *Collybia radicata*, usually so abundant, was very rare, but *C. dryophila* was more common than usual; *C. platyphylla* and a few other species were also collected. *Mycena* was represented by several of the smaller species, *Omphalia* by *O. campanella*, *O. epichysium* and others, *Pleurotus* chiefly by *P. ostreatus*, and *Hygrophorus* by *H. conicus* and a few other brilliantly colored species. The rosy-spored agarics were represented by a few species of *Clitopilus*, *Entoloma* and *Leptonia*. *Flammula*, *Inocybe*, *Hebeloma*, *Claudopus* and *Crepidotus* were also collected, the last being quite abundant in *C. versutus*.

Clavaria was more abundant than I have ever seen it before, it being one of the few genera of fungi that can exist and thrive in such dense shade as that of *Kalmia* and *Rhododendron* overtopped by forest trees. Several species of *Clavaria* were collected for the herbarium, and certain of the larger forms were gathered almost daily during my stay for table use. Other fungi made use of in this way were *Lactarius volemus*, two or three species of *Russula*, *Pleurotus ostreatus*, *Lycoperdon gemmatum*, *Cantharellus cibarius* and *Hydnum repandum*. It was too early in the season for a number of excellent autumnal species of gill-fungi and for a sufficient quantity of many of the edible *Boleti*. The species to be avoided at this time in the collections for the table were chiefly *Amanita phalloides* and most other species of *Amanita*, *Lactarius rufus*, *Russula foetida*, *Russula emetica* and *Cantharellus aurantiacus*. A very common branched species, *Lachnocladium Schweinitzii*, resembling *Clavaria* in form, was easily distinguished by its exceeding toughness and flexibility.

The Hydnaceae collected were nearly all terrestrial species, *H. imbricatum*, *H. repandum* and *H. putidum* being abundant. *Calostoma cinnabarium* was the most abundant member of the Gastromycetes, while *Lycoperdon* and *Geaster* were sparingly represented in three or four woodland species. The season for *Morchella* had past, but *Spathularia velutipes*, *Leotia lubrica*, *Sarcoscypha coccinia*, and a few other Discomycetes were fairly abundant.

Two species of *Cordyceps* were collected, *Cordyceps militaris* in several specimens on pupae of a species of moth buried under moss and leaf-mold, and an undetermined species on the larva of a large moth which had fallen among mud and leaves by the roadside. Several specimens of *Tremella mycetophila*, parasitic on *Collybia dryophila*, were found. The wild crabs were all affected with *Gymnosporangium*, and the wild plum and cherry trees were frequently found covered with *Plowrightia*. *Exobasidium* was rather common on species of *Vaccinium* and *Azalea*. Many of the best known parasitic fungi were rare, as might be expected in such a locality, but wood-destroying kinds, both saprophytic and parasitic, mostly belonging to the Polyporaceae, were quite abundant.

The principal wood-destroying species observed were, *Porodaedala Pini*, on pitch pine; *Pyropolyporus igniarius*, on species of oak; *Pyropolyporus Robiniae*, common on all the black locust trees seen; *Fomes populinus*, chiefly on maple; *Elfvingia megaloma*, common on several hard-wood species; *Ganoderma Tsugae*, on hemlock; *Laetiporus speciosus*, common on oak and a few other hard woods; *Grifola Berkeleyi*, at the base of oak and chestnut trunks, attached to the roots; *Inonotus hispidus*, on oak; *Coriolus versicolor*, on various hardwoods; *Fistulina hepatica*, on chestnut; and *Hydnum septentrionale*, on black gum. *Daedalea quercina* was not seen. As beech and birch were very rare in the valley, no specimens of *Elfvingia fomentaria* were collected, although it must be common at other elevations. *Armillaria mellea*, a very destructive root-rot, was known to be present in abundance, but the sporophores were only beginning to appear.

The chestnut canker was not seen in North Carolina. The chestnut tree is of immense importance in the Biltmore Forest, being cut in great quantities annually for lumber and for tannin extract. It is said that the successful employment of chestnut wood pulp, now a waste product from the extract factory, for the making of paper, would increase the value of Pisgah Forest, with its wealth of chestnut timber, one hundred per cent. This tree is very sensitive and is dying in many parts of the forest from the effects of the chestnut borer and the disturbance of the natural forest conditions, but, fortunately, this new disease, so abundant and destructive about New York, has not yet been introduced at Biltmore.

Besides the polypores mentioned in the above list of wood-destroying species, *Aurantiporus Pilotae* was twice collected on decayed oak logs, *Cycloporus Greenei* was found in two places along the roadsides attached to underground roots, and *Microporellus dealbatus* was common in open thickets on the roots of various members of the heath family. *Coltricia cinnamomea* was very abundant on the banks along the roads and trails, while *C. perennis* was found only once and *C. obesa* twice.

The Boletaceae, while not as abundant in July as a little later in the season, were well represented by a number of very interesting species, and particular attention was given to this group, which can be profitably studied only from fresh specimens. Over one hundred special collections of *Boleti* were made, comprising about forty species, and all of these were critically studied and described in the field. A list of these, with notes of special interest, will be published elsewhere.

In closing, I wish to express my appreciation of the cordial reception tendered me by Dr. and Mrs. Schenck and the young men of the Forest School, and of the efforts of everyone to make my visit delightful as well as successful. I wish also to thank Mr. Vanderbilt for the privileges I enjoyed on the estate.

Respectfully submitted,

W. A. Murrill,

Assistant Director.

OUR DUTY TO THE PARKS.

Every privilege brings with it a duty. Every good thing that we have ought to have two effects upon us. It should cause us to take care of it. It should make us willing to let others have the good of it as well as ourselves.

We all love the great and beautiful parks of our city — those wonder places, those stretches of country sweetness and freshness and greenness and beauty, set right down in the busy city streets to refresh and cheer and charm us. Many a city child owes its good health to the trees and streams and fountains in the parks. And almost all city children love these pleasant playgrounds.

And what duty does this lovely gift bring with it? Surely we should do our best to keep the parks at their fairest, surely we should obey all the rules that are made to protect them, surely we should be willing that those who come and see them after we have gone to our homes should find them as beautiful and pleasant as we did.

Bronx Park is perhaps the most marvellous of all our city parks, because it is instructive as well as charming. And yet, last Saturday, I saw two little girls wantonly tearing off great bunches of the flowering phlox that the city had carefully nurtured for us all to enjoy together.

They were hurting the bushes, and stealing the flowers. I say "stealing" because no one person has any right to take and keep for himself the things that belong to all of us together.

If any of you, my boys and girls, see anyone devastating the people's garden, I want you to be good citizens, and go right up to them and make them stop.

If they will not obey you, tell them that you will call a gardener; and, if that does no good, call one.

It is your duty to the city of New York.

—The Bronx Home News, Friday, July 31, 1908.

A COLLECTION OF VINES.

The recent labelling of the collection, and the construction of adjacent paths, has practically made available to the public the beautifully installed and interesting collection of vines. The secluded nature of its position, and lack of comprehensive labels, has tended to obscure a plantation that has developed into one of the most picturesque features in the Garden.

The Viticetum is just west of the border of the Hemlock Forest, and winds for about three hundred feet along the ridge to the east of the Economic Garden. At present the collection consists of thirteen families, seventeen genera, and thirty-four species, represented by about seventy specimens. The plants are supported by a substantial arbor of rough-hewn logs, and there is a pathway underneath so that people may walk from one end to the other. The vines are planted along both sides of the arbor and some of them have already run wild over the top. During the spring and summer the walk underneath is a beautifully shaded cloister with a charming vista looking down into the hemlock woods.

Beginning at the southerly end, one of the first of the larger plants is the Dutchman's pipe of the eastern states, belonging to the birthwort family. It is a splendid vine for covering porches, its large kidney-shaped leaves affording a dense shade. The plant is also interesting as being a northern representative of a genus, *Aristolochia*, that in tropical countries produces perhaps the largest flowers known, except in *Rafflesia*. In this native species, however, they are small and half hidden by the leaves. They are of a curious pipe-like shape, and it is from this resemblance that the plant has derived its common name.

Near the Dutchman's pipe is *Brunnichia*, of the buckwheat family, one of the few native representatives of the group that is enough of a trailer to warrant its appearance in such a collection as this. It is little more than a climbing herbaceous perennial.

Just above this is a collection of the familiar *Clematis*. None of the plants are very large as yet, and *Clematis vitalba*, or "Traveller's Joy," of England, is scarcely what one would expect from reading descriptions of this historic vine. It was called "Traveller's Joy" by Gerarde in his Herbal (1597), and it is interesting to read what he said then of one of the most beautiful vines of rural England: "These plants have no use in Phisicke, as yet found, but are esteemed onely for pleasure, by reason of the goodly shadowe which they make with their thicke bushing and clyming, as also for the beautie of the flowers and the pleasant sent (*sic*) and savour of the same."

The "Akebi Kadsura" (*Akebia quinata*) from China and Japan is a graceful climber with a 5-foliolate leaf, and curious flowers with three petals. It is a member of the Voqui family (Lardizabalaceae), and, except a single plant at the conservatory, it is the only representative of the family in the collections of the Garden. The fruit is eaten by the Japanese, and Chinese native druggists make an emollient from the sap that is used in bronchial troubles. The orientals of San Francisco use a vegetable decoction, a large part of which is made from the juice of "Akebi," that is credited with being the usual panacea for all ills; much after the fashion of similarly exploited occidental remedies. The flowers are fugitive, being of a dark red color and partly hidden by the profusion of leaves.

Passing by the *Actinidia* or "Saru Nasi," the fruits of which are eaten by the Japanese, we come to the group of wistarias. Of all the vines suitable for arbors or porches these are perhaps the most beautiful. The delicacy of their color and the harmony and grace of their flower-clusters will always make them most desirable for decorative planting. They are particularly well suited for city homes, for they seem to have the faculty of taking good care of themselves under apparently adverse conditions.

The Japanese honeysuckle (*Lonicera japonica*) is a particularly sweet-smelling climber and well merits its popularity as a cover for fences and trellises. It was introduced into England by the Dutch East India Company in the early part of the last century and has spread throughout the civilized world.

But space forbids an account of all the vines in the collection. However, mention must be made of the grapes, bittersweets, and Virginia-creepers, all represented by good-sized plants. There is also a fine plant of the trumpet-creeper, just now showing an abundance of scarlet and orange flowers.

There is still room for expansion in the collection, and it is ultimately planned to include all the vines that will stand the variations of our climate. The collection will then be one of great interest botanically, and will also serve to illustrate the horticultural possibilities of vines at present little used for decorative purposes.

NORMAN TAYLOR.

SUPPLEMENT TO THE MERCK COLLECTION OF PROXIMATE PRINCIPLES OF PLANTS.

Messrs. Merck & Co. have supplemented their valuable and important gift of last year, consisting of several hundred vegetable principles, with a collection of most of the crude vegetable substances from which the former are derived. This addition comprises one hundred and twenty articles, many of them of considerable rarity. While many of the substances are represented by but a single constituent, others possess several. Opium heads the list with twelve constituents, mostly alkaloids. Cinchona follows with eight, amygdala and ergot with five each, and coca, dita, digitalis, sabadilla, turpentine, soap-bark, and belladonna have four each.

The new acquisition necessitates an entire rearrangement of the original collection. It has heretofore been classified according to the chemical nature of the products, and in this form has attracted much attention from visitors during the year, especially from students. By the new arrangement, the crude articles stand in botanical sequence, and each is surrounded by the principles pertaining to it. Suitable pedestals and labels are now being prepared for each of these groups. The collection now comfortably fills an entire section of cases, and may be found in the northwest corner of the Economic Museum.

NOTES, NEWS AND COMMENT.

Dr. Homer D. House, who was connected with the Garden and Columbia University in 1902–04 and again in 1907–08, has recently accepted the position of associate director in the Biltmore Forest School.

Dr. Raymond H. Pond, research scholar at the Garden at various times during 1905, 1906, and 1907, has been appointed biologist of the Metropolitan Sewerage Commission of New York, to investigate important biological problems connected with New York Harbor.

Mrs. Cornelius Van Brunt has recently given the Garden an assortment of over five hundred museum bottles, which will be used chiefly for preserving in alcohol or formalin the flowers of rare orchids as they appear in the conservatories.

Mr. H. von Türckheim, the veteran botanical collector of Coban, Guatemala, visited the Garden August 13 and 14, on his way to Europe. He began collecting for Mr. John Donnell Smith nearly twenty-five years ago, and the Garden has been receiving his collections, directly or indirectly, for the past ten years or more. Practically all of his collecting work was done in Guatemala.

The severe drought which was experienced during June and the first part of July was broken by the showers at the middle of July, and there has been sufficient rainfall ever since, although the rainfall of the summer is still considerably below the average. Grass has grown again on the burnt portions of lawns and banks and, while newly planted shrubs were considerably set back, the actual loss has not been very great, much less indeed than was feared. This experience has emphasized the need for an extension of the water-supply system, and it is planned to accomplish this by the expenditure of a portion of the recent additional appropriation for construction made by the city.

An additional construction appropriation of $25,000, voted by the Board of Estimate and Apportionment June 26, 1908, adopted by the Board of Aldermen July 21, and approved by His Honor the Mayor August 4, will be expended in the continuation of construction of driveways and paths, principally on the eastern side of the grounds, in the completion of the grading operations necessary at the museum building, in the extension of the system of water-supply and drainage, and for minor works. All the earth and rock to be excavated at the museum building is required for filling and for the telford foundation of roads and paths, so that the same money will effect two pieces of work, as has been the case in nearly all the grading operations hitherto accomplished, a result made possible by following the original plan of development approved by the Board of Managers in December, 1896. It is now planned to complete the driveway system and to build at least an additional mile of paths.

Meteorology for July.— The total precipitation recorded for July was 3.29 inches. Maximum temperatures were recorded of 92.5° on the 5th, 99.5° on the 6th and 12th, 95.5° on the 19th and 20th, 89.5° on the 27th, 28th and 31st; also minimum temperatures of 63° on the 1st, 52.5° on the 9th, 54° on the 17th, and 63° on the 26th. The mean temperature for the month was 76°.

ACCESSIONS.

MUSEUMS AND HERBARIUM.

47 specimens of flowering plants from central New York. (By exchange with Dr. H. D. House.)

9 specimens of flowering plants from Jamaica. (By exchange with the Department of Agriculture, Jamaica, W. I.)

21 specimens of flowering plants from Long Island. (Given by Dr. R. M. Harper.)

45 specimens of cacti and Crassulaceae from North America. (By exchange with the U. S. National Museum.)

8 specimens of mosses from Scotland. (Given by Mr. J. Hunter.)

42 specimens of mosses and hepatics from the Philippine Islands. (Collected by Professor A. D. E. Elmer.)

33 photographs, mostly of cacti. (By exchange with the U. S. National Museum.)

50 specimens "Hepaticae Europaeae Exsiccatae, series V, nos. 201–250." (Distributed by Dr. Victor Schiffner.)

5 specimens of flowering plants from Nantucket, Mass. (Given by Mr. E. P. Bicknell.)

3 specimens of *Nopalea*. (By exchange with U. S. National Museum.)

50 miscellaneous specimens from Jamaica. (By exchange with the Department of Agriculture, Jamaica, W. I.)

27 specimens of flowering plants from the Philippine Islands. (By exchange with the U. S. National Museum.)

5 specimens of drugs. (Given by Dr. H. H. Rusby.)

11 specimens of mosses from Westchester County, New York. (Collected by Mrs. N. L. Britton.)

18 specimens of mosses from Northern Black Hills, South Dakota. (By exchange with Miss F. Grace Ernst.)

PLANTS AND SEEDS.

7 plants from Jamaica for conservatories. (Collected by Dr. and Mrs. N. L. Britton.)

10 filmy ferns from Jamaica. (Collected by Mr. William Harris.)

1 plant of *Sedum Poloseni* for conservatories. (By exchange with the U. S. National Museum, through Dr. J. N. Rose.)

18 succulents for conservatories. (By exchange with Mr. F. Weinberg.)

19 orchids from Costa Rica. (By exchange with Mr. J. C. Zeledon.)

1 *Opuntia* for nursery from Colorado. (Given by Dr. T. D. A. Cockerell.)

1 seedling of *Sequoia* for conservatories. (Given by Mr. G. N. Tricoche.)

2 plants for herbaceous collections. (Collected by Mr. F. Weinisch.)

1 plant of *Leea* for conservatories. (By exchange with Fairmount Park, Philadelphia.)

1 packet of seed of *Astragalus Blakei* from Vermont. (Given by Mr. W. W. Eggleston.)

2 packets of seeds of economic plants. (Given by Dr. H. H. Rusby.)

53 plants derived from seed from various sources.

JOURNAL

OF

The New York Botanical Garden

Vol. XI September, 1908. No. 105.

REPORT ON BOTANICAL EXPLORATION IN PANAMA.

Dr. N. L. Britton, Director-in-Chief.

Sir: In accordance with your instructions, I left New York January 25, 1908, for the Republic of Panama, in order to make collections for the Botanical Garden, especially outside of the canal zone. I was delayed by illness for two weeks at Kingston and did not reach Colon until February 16, where I remained over Sunday, taking the 8:40 A. M. train the next day for Panama, a ride occupying over three hours, owing to the many stops at stations along the route of forty-eight miles.

The entire canal zone, as well as Colon and Panama, was so greatly improved since the American occupation that I scarcely recognized it as the same region passed over a few years before. After getting located at one of the many hotels in Panama, I called on Pinel Brothers, to whom I had a letter of introduction from the Colon agent of the Royal Mail Steam Packet Company, to inquire about transportation to Pacific coast ports within the Republic of Panama. From the information kindly given me I concluded to make my headquarters at Penonome for a time, the town being some twenty miles inland, in the vicinity of mountains, and some one hundred miles west of the canal zone. As the next boat for Porto Posada, the nearest landing to Penonome, did not leave for several days, I put in some time collecting near the town.

Panama bay has a tide of sixteen or eighteen feet, and at low water numerous rocks project one third to one half mile from shore. Here I spent parts of two days looking for algae, but with little success, only six or eight species being obtained. These were all attached to rocks, and I observed no specimens drifting in along shore. Doubtless some of the many islands a few miles out in the bay would prove better collecting ground.

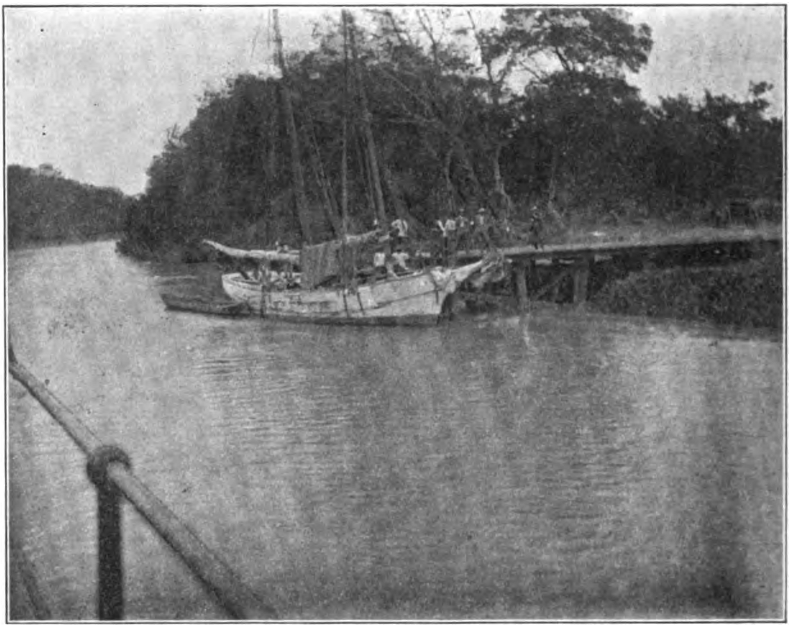

FIG. 23. Porto Posada, the nearest port to Penonome.

Another day was passed in climbing Ancon Hill, just outside of the town and 600 feet above the ocean. The hill is partly covered with rather small timber and brush, with grass-covered slopes intervening, but at this season the grass was dry and brown, while many of the trees and shrubs were more or less leafless and wilted from the hot sun. However, a few species were just coming into bloom, and quite a number of others were bearing fruit. Mosses and lichens, of the larger forms at least, were scarce, and I did not secure a specimen of either.

On February 22, I boarded the small steamer "Cocle" bound for Penonome. We left Panama about 8 A. M. and, after making short stops at the island of Taboga and the Port of San Carlos, came to anchor at midnight off the mouth of the Sarotee River. At daylight we began steaming up the river, which proved to be a stream of moderate size with but little current and with low, often heavily wooded banks, the mangrove being one of the

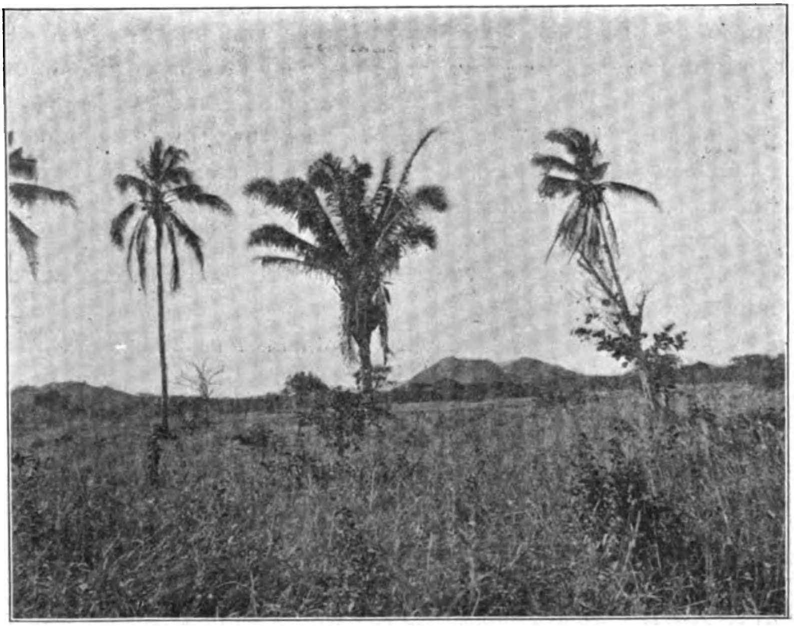

FIG. 24. Palms near Penonome. The one in the center is the oil-nut palm; the others are cocoanut palms.

most conspicuous trees. White and blue herons, parrots, and sandpipers were common, otherwise we noticed little animal life. We reached Porto Posada in about two and one half hours, and found it to consist of a small wharf with a couple of open sheds a few rods away, from which a nearly straight road led to the town of Penonome, some twelve or fourteen miles distant. Mosquitoes were in swarms and no fresh water apparently to be had for miles, except that on the boat. I had ordered a saddle horse to take me to the town, but, finding only some ox-carts for the freight, concluded to walk and do some collecting along the way. This proved rather more of an undertaking than I had counted on, having had almost nothing to eat since the day before at noon. There was no food or water to be had on the way and having stopped here and there along the road to collect, I reached the town seven hours later, dry and hungry, with a well-filled press.

Penonome is situated at the upper side of a rather level savanna at the foot of hills that reach down from low, more or less timber-covered mountains beyond. The place is only a hundred feet or two above sea level, with the nearer hills some six or eight hundred feet higher. It proved to be a town of some importance, being the capital of the province, and consisted of several hundred native inhabitants, quite a number of Spaniards, some Frenchmen, and at least one American and one German. The streets, though narrow, seemed quite clean, and the connected houses, which were built in long narrow blocks, were mostly entirely without yards and with doors opening directly to the streets on either side.

Many of the trees about town seemed to be cultivated, among them the cocoanut and oil-nut palm. A species of *Anacardium*, called Maranyon, was common, and furnished an edible fruit, or rather an edible pedicel to the flat, stony fruits that were used by the children in a game somewhat like marbles. A species closely related to this was indigenous along the river near by, and proved to be one of the largest and commonest trees of the region. Of the plant families, the Papilionaceae were best represented. Species of the Melastomaceae were also abundant, while climbing shrubs and small trees belonging to the Polygalaceae were in sight almost everywhere, with handsome clusters of pink and purple flowers. Orchids were fairly common in favorable localities but only two or three particularly noticeable species were found. Among other genera of this family two species of vanilla were obtained.

I lived during my residence in the town with Mr. Hugo Henne, the proprietor of a hotel for travelers, and he not only gave me excellent board, but every assistance possible to make my stay profitable. I remained there from February 23 to March 23, making in the meantime two trips with Mr. Henne to his rubber estate, " Bismark," situated some twenty miles up the river at an elevation of perhaps 2,000 feet. Low mountains surrounded the plantation on nearly all sides and the climate was much moister than below, light showers occurring frequently, which kept everything green, in strong contrast to the parched lands at Penonome. My visits, of scarcely two days duration on each trip, were quite insufficient to fully explore even the immediate vicinity.

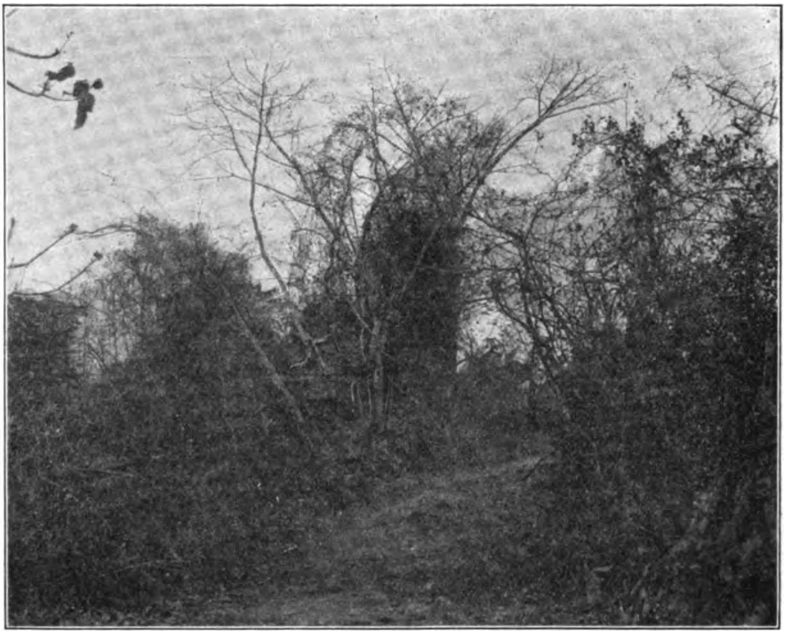

FIG. 25. Road leading to Old Panama.

On March 23, I left Penonome and rode to Porto Posada, where I found the steamer waiting for high tide in order to proceed down the river. We finally started at five o'clock and reached Panama about eight o'clock the next morning. I now wished to collect on the other side of the canal toward the Colombian border, and at length arranged with Mr. Pinel, the agent of the only regular steamer running to that region, to take me to the Gulf of San Miguel and up the Tuira River about forty-five miles to a small town known as El Real.

While waiting for the next boat I made a short visit to the ruins of Old Panama, five or six miles along the coast and eastward from the present town. Most of the city was built of wood and was wholly burned by Morgan when he sacked the place in 1671, but the old stone tower, a bridge or two, and various foundations still remain, surrounded by a tangle of bushes, trees and banana plants. I carried a plant press along, but brought

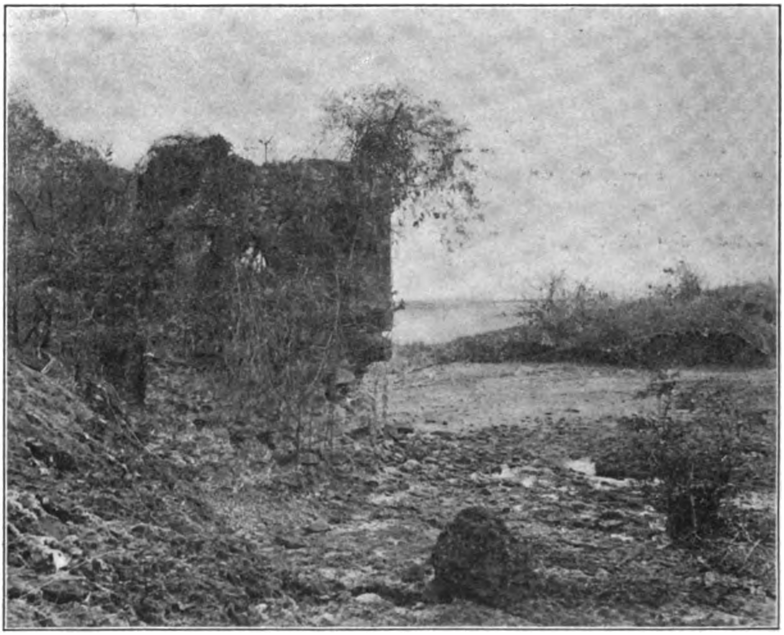

FIG. 26. Part of sea-wall in Old Panama.

back only a species of lichen, *Ramalina*, that quite covered some of the low bushes. Many of the trees and shrubs were leafless and not suitable for specimens.

On April 1 I took the steamer "Cana" for El Real. We left Panama about 6:30 P. M. and reached the Gulf of San Miguel at nine o'clock the next morning, passing many small volcanic islands and reefs, which, in connection with the tidal currents, make navigation rather dangerous at times. The lower gulf seemed six or eight miles wide in places and the tide runs up the Tuira River some fifty or sixty miles from the coast. As we ascended the river we found the banks heavily wooded and saw numerous birds, and shortly before reaching El Real we passed quite a number of alligators swimming or floating along the shores, looking much like rough logs well sunken in the water.

Knowing little about the country, I had intended to go to Yavisa, a small native town well in the interior of Darien, but the officers of the boat told me that there I would be farther from mountains than at El Real. Accordingly, on the recommendation of the captain, the agent of the Darien Gold Mining Company agreed to let me stay at their station, called Marraganti, a few miles farther up the river, and here I remained for over a week, collecting on both sides of the Tuira. The region in general was low, there still being six feet of tide in the river, with heavy forests covering much of the country. One tree in particular was very conspicuous, growing in groups, with a round, smooth trunk seven or eight feet in diameter, and attaining a height of probably 150 feet or more. At this season it was leafless but bore clusters of winged fruits four or five inches in diameter, which, when blown off by the wind, appeared from a distance like a flock of birds. Another quite common and very large tree was evidently related to the Brazil nut, *Bertholletia*, and bore round, very thick, woody capsules seven or eight inches in diameter, packed with triangular nuts.

I remained at this station nine days, but wished to collect at higher elevations, and was fortunate in meeting Mr. Lachszyrma, Manager of the Darien Gold Mining Company, who came down to Marraganti while I was there. He kindly consented not only to transport myself and baggage to the mining camp, but to furnish room and board for a time under the same conditions as for an employee of the company. It took me from April 11 to April 16 to reach the camp known as "Cana." The first day's travel was up the river in a dug-out canoe, or *peragua*, with two skilled natives to pole and paddle the boat, which contained not only my own baggage but some 1,200 pounds of iron rails as well. The river banks we passed were mostly low and in places, for a mile or so at a stretch, showed four of the most perfectly arranged zones of vegetation that I have ever seen. In the background was a growth of *Cecropia*, a graceful tree perhaps fifty feet high, with slender spreading branches; next below came a dense belt of chara (*Gynerium*), or sometimes in place of this false banana (*Heliconia*); next, on the steeper bank, another coarse grass, but much lower than *Gynerium;* and, near the water, a low grass forming a rather dense sod.

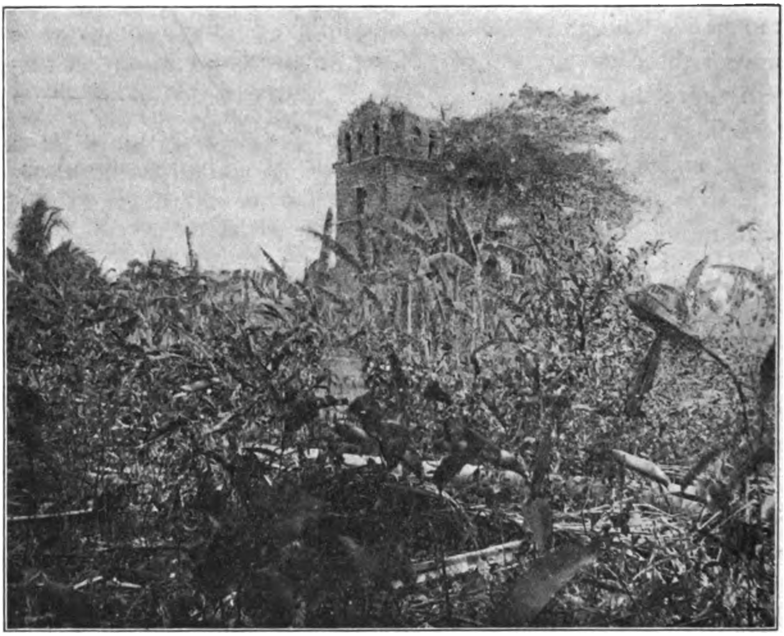

Fig. 27. Tower of Old Panama.

We reached the first company station above Marraganti the second afternoon out, having passed the night on a sandbar without trouble either from mosquitoes or other insects. At this station I remained over one day to collect, but the region was very dry and quite like that lower down stream. On April 14 I proceeded to the next station, called "Cituro." The greater part of this distance was made in the cabin of a forty-ton engine balanced over a two-foot gauge track. As the railway was not quite completed to the station, I walked the remaining two or three miles with a plant press. The country about this station seemed considerably higher and moister than down the river, with open grassy hills here and there, causing a decided change in the character of the vegetation. I collected the part of an afternoon here and the next morning mounted a mule for the third and last station, called "Paca," before reaching my destination. The distance was only about thirteen miles and I had an-

FIG. 28. The base of the tower shown in the previous figure.

other afternoon in which to do some collecting. The morning following I started afoot for Cana, ten miles distant, with only my plant press, the baggage to be forwarded the next day. A great many interesting plants were found along the road and my press was easily filled some time before I reached the town.

Cana is situated at the base of the Espirito Santo Mountains, at an elevation of some 2,000 feet, the mountains reaching an elevation of about 7,000 feet and being well covered with forests to their summits. It is claimed that from one of the higher peaks of this range, Balboa first saw both the eastern and western oceans some four centuries ago.

April 17 being Good Friday, no freight arrived in camp and my baggage including dryers and a good many plants in press, did not reach me until the afternoon of the next day. I was afraid many of the specimens would be spoiled, but fortunately only a few had to be thrown away. The following morning, with plenty of papers and dryers on hand, I was able to get out and do some collecting, but good weather did not last much longer, for on April 21 the wet season started in abruptly with heavy showers, and my last collecting of any extent was done on April 27, although a few specimens were obtained at various times in May, whenever I was able to get out.

Probably between 900 and 1,000 species were collected on the entire trip. Of the lower forms, Dr. Murrill has already examined the small collection of fungi and reports some 24 species. Of these, 17 are common tropical or world-wide species. Of the remaining 7, 6 species are interesting or rare, while one is perhaps undescribed, although collected before in Cuba.

I have rather carefully looked over the true mosses and find some 30 species. Of these, 24 are found in South America, including 2 that are world-wide in tropical regions and 4 that are also found in North America. The remaining 6 species are at present apparently known only from Central America, three of these being probably undescribed.

Respectfully submitted,

R. S. Williams,
Assistant Curator.

AUTUMN LECTURES, 1908.

Lectures will be delivered in the lecture hall of the museum building of the Garden, Bronx Park, on Saturday afternoons, at four o'clock, as follows :

Oct. 17. "Edible and Poisonous Mushrooms," by Dr. W. A. Murrill.

Oct. 24. "Wild Autumnal Flowers and Fruits," by Dr. N. L. Britton.

Oct. 31. "Letchworth Park and the Falls of the Genesee," by Mr. George V. Nash.

Nov. 7. "Plant Distribution as Interpreted by Geology,'' by Dr. Arthur Hollick.

Nov. 14. "Botanical Cruises in the Bahamas," by Dr. M. A. Howe.

Nov. 21. "

," by Dr. H. H. Rusby.

The lectures will be illustrated by lantern slides and otherwise. They will close in time for auditors to take the 5:34 train from the Botanical Garden Station, arriving at Grand Central Station at 6:04 P. M.

The museum building is reached by the Harlem Division of the New York Central and Hudson River Railway to Botanical Garden Station, by trolley cars to Bedford Park, or by the Third Avenue Elevated Railway to Botanical Garden, Bronx Park. Visitors coming by the Subway change to the Elevated Railway at 149th Street and Third Avenue.

NOTES, NEWS AND COMMENT.

Professor John Dearness, of London, Ontario, visited the Garden on August 29. Professor Dearness has been an enthusiastic collector of fungi in Canada and has contributed largely to the Ellis Collection, now deposited in the herbarium of the Garden.

Mr. H. S. Jackson, of the Delaware Agricultural Experiment Station, spent over two weeks at the Garden in September completing his list of the fungi of Delaware. The Ellis collection contains a large number of specimens collected in Delaware by Mr. Commons.

Dr. Britton entertained the members of the Garden Staff on August 19, on the occasion of the departure of Dr. C. Stuart Gager for the University of Missouri. Dr. E. O. Hovey, of the

American Museum of Natural History, and Mr. C. William Beebe, of the New York Zoölogical Park, were also present and gave interesting accounts of their recent explorations in Tropical America.

On August 28, 1908, a thousand or more dead English sparrows were found on the grounds of the Garden, especially in the shrubbery about the elevated approach and along the railway line on the west side. In one small area 620 dead birds were picked up where they had fallen from the shrubs at night. Their death was due to the heavy cold rain of August 25 and 26 accompanied by a night temperature of 50° or lower. The premature cold was too great for the young birds as yet poorly supplied with feathers. The death of sparrows in other places about the city was noted in the papers at this time. The English sparrow is a decided nuisance on the grounds and about the buildings of the Garden, especially in the conservatories and around the eaves of the museum building. It will be interesting to note the effect of this wholesale slaughter upon the number of birds next year.

Meteorology for August. — The total precipitation recorded for the month was 7.19 inches, 6 inches being recorded for the week beginning August 22. Maximum temperatures were recorded of 92.5° on the 11th, 94° on the 14th, 88° on the 19th, and 81.5° on the 30th; also minimum temperatures of 69.5° on the 8th, 59.5° on the 11th and 16th, 50.5° on the 21st, and 45.5° on the 28th.

ACCESSIONS.

LIBRARY ACCESSIONS FROM JULY 1 TO AUGUST 31, 1908.

BUSEMANN, L. *Der Pflanzenbestimmer.* Stuttgart, 1908.

CHUN, CARL. *Wissenschaftliche Ergebnisse der deutschen Tiefsee-Expedition auf dem Dampfer "Valdivia" 1898–99.* Zweiter Band, erster Teil, Lieferung 1–2; Zweiter Band, zweiter Teil. Jena, 1905–07.

GISEVIUS, PAUL. *Das Werden und Vergehen der Pflanzen.* Leipzig, 1907. (Given by the Trustees of Columbia University.)

GORDINIER, HERMON CAMP, & HOWE, ELLIOT CALVIN. *The flora of Rensselaer County, New York.* Troy, 1894. (Given by Dr. H. C. Gordinier.)

HANNIG, GEORG. *Der Friedhof und seine Kunst.* Berlin, 1908.

HAYEK, AUGUST VON. *Flora von Steiermark.* Erster Band, Heft 1. Berlin, 1908.

Index Kewensis. Suppl. 3. Oxonii, 1908.

JUNK, WILHELM. *Indices nominum trivialium ad: Linnaei Species plantarum, ed. I.* Berlin, 1907.

JUNK, WILHELM. *Linné's Species plantarum, editio princeps, und ihre Varianten.* Berlin, 1907.

KENTER, J. *Morphologisch-biologisches Skizzenbuch.* Ausgabe A: Botanik. Arnsberg, 1908.

KRONFELD, E. MORITZ. *Anton Kerner von Marilaun: Leben und Arbeit eines deutschen Naturforschers.* Leipzig, 1908.

LELIEVRE, J. F. *Nouveau jardinier de la Louisiane.* Nouvelle-Orleans, 1838. (By exchange with Howard Memorial Library.)

LINDAU, GUSTAV. *Nylanderi Synopsis Lichenum index.* Berlin, 1907.

NORDSTEDT, CARL FREDRIK OTTO. *Index Desmidiacearum.* Supplementum. Lundae, 1908.

SCHLECHTENDAL, DIEDERICH FRANZ LEONHARD VON, LANGETHAL, CHRISTIAN EDUARD, & SCHENK, ERNST. *Flora von Deutschland.* 3te Aufl. Jena, 1845–72. 21 vols.

Switzerland, Departement des Innern. Baum- und Waldbilder aus der Schweiz. Erste Serie. Bern, 1908.

TSCHIRCH, ALEXANDER. *Die Chemie und Biologie der pflanzlichen Sekrete.* Leipzig, 1908.

TSCHIRCH, ALEXANDER. *Handbuch der Pharmakognosie.* Lief. 1. Leipzig, 1908.

VINCENT, FRANK. *The plant world: its romances and realities.* New York, 1899 [1897]. (Given by Dr. J. H. Barnhart.)

WAGNER, MAXIMILIAN. *Biologie unserer einheimischen Phanerogamen.* Leipzig, 1908.

WALLIS, E. J. *Illustrations of the Royal Botanic Gardens, Kew.* (Kew, 1908.) (Given by Dr. N. L. Britton.)

WESTERMAN, WILHELM. *De tabakscultuur op Sumatra's oostkust.* Amsterdam, 1901. (Given by the Trustees of Columbia University.)

WINKLER, HANS. *Parthenogenesis und Apogamie im Pflanzenreiche.* Jena, 1908.

MUSEUMS AND HERBARIUM.

2,500 specimens from Panama. (Collected by Mr. R. S. Williams.)

16 specimens of woody fungi from the Philippine Islands. (By exchange with the Bureau of Science, Manila, P. I., through Mr. E. D. Merrill, Botanist.)

750 specimens of fleshy fungi from Pisgah Forest, North Carolina. (Collected by Dr. W. A. Murrill and Dr. H. D. House.)

25 specimens of fleshy fungi from Falls Church, Virginia. (Collected by Dr. W. A. Murrill.)

2 specimens of Hepaticae from New Hampshire. (Given by Miss Annie Lorenz.)

1 specimen of *Epipactis viridiflora* from New York. (Given by Mr. George V. Nash.)

6 specimens of flowering plants from Westchester Co., New York. (Given by Mrs. N. L. Britton.)

100 specimens, "Bryotheca Exotica, Ser. I." (Distributed by Mr. E. Levier.)

21 specimens of mosses from Central America. (Distributed by Mr. F. Renauld.)

1 specimen of *Amblystegium hygrophilum* from Pennsylvania. (By exchange with Dr. George N. Best.)

8 specimens of *Zygodon* from England. (By exchange with Mr. H. N. Dixon.)

1 specimen of moss from Guatemala. (Given by Mr. H. von Türckheim.)

1 specimen of *Albugo Froelichiae* (cotype). (Given by Professor Guy West Wilson.)

16 specimens of *Peronosporales* from India. (Given by Professor Guy West Wilson.)

1 specimen of *Tyromyces palustris* from Miami, Florida. (Given by Professor Ernst A. Bessey.)

3 specimens of *Boleti* from Stockholm, Sweden. (Given by Mr. L. Romell.)

98 specimens of fleshy fungi from Pisgah Forest, North Carolina. (Given by Dr. H. D. House.)

20 specimens of fleshy fungi from Herradura, Cuba. (Given by Professor F. S. Earle.)

6 specimens of fungi from Corvallis, Oregon. (Given by Professor E. R. Lake.)

41 specimens of fungi mostly from North Carolina. (Given by Professor G. F. Atkinson.)

30 specimens of woody fungi from Seattle, Washington. (Given by Professor T. C. Frye.)

4 specimens of sac-fungi from Utah. (Given by Professor I. D. Cardiff.)

4 specimens and two photographs of *Lepiota Americana* from Redding, Connecticut. (Given by Professor A. L. Treadwell.)

PLANTS AND SEEDS.

1 plant of *Echinocactus* sp. for conservatories. (Given by Mr. H. Dennerstein.)

1 plant of *Cattleya* sp. from Guatemala for conservatories. (Given by Mr. H. von Türckheim.)

1 plant of *Allium cernuum* for herbaceous grounds. (Given by Dr. H. H. Rusby.)

9 cactuses from Colorado for herbaceous grounds. (Given by Dr. C. E. Bessey.)

8 cactuses from Mexico for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

VIEW IN THE MAIN HERBARIUM ROOM.
Compare Pl. II in the JOURNAL for March, 1900.

JOURNAL

OF

The New York Botanical Garden

Vol. IX. November, 1908. No. 106.

FURTHER EXPLORATION IN JAMAICA.

To the Scientific Directors,

Gentlemen: — In accordance with previous authorization and with the approval of the president of the Board of Managers of the Garden, I have continued the botanical exploration of the island of Jamaica and the collecting of plants and specimens for the greenhouses, museums and herbarium during a period of about four weeks, being absent from the Garden for the purpose from August 22 to September 30, 1908, this being my fourth trip to Jamaica.* I was accompanied by Mrs. Britton, who materially supplemented our collections of cryptogamic plants during the trip, besides giving much aid in the preservation and preparation of the general collection made, and she remained on the island for two weeks subsequent to my return for the purpose of visiting portions of the interior mountain region in search of plants not yet secured. Sailing from New York August 22 on the Royal Mail Steam Packet "Tagus," we arrived at Kingston without incident on August 27. Proceeding at once to Hope Gardens, consultation was had with the Hon. H. H. Cousins, Director of Agriculture of the Jamaica Government, and with Mr. Wm. Harris, Superintendent of Public Gardens, and a scheme of exploration was determined upon, planned to enable us to visit portions of the island which we had not seen during our three previous trips. To our great satisfaction it had already

* See Journal New-York Botanical Garden 7: 245; 8: 229; 9: 81.

been arranged that Mr. Harris would accompany us during most of the time. I had begun, during the past summer, in coöperation with Mr. Harris through correspondence, the preparation of a Flora of Jamaica, and brought with me a copy of the manuscript for almost one third of this work; considerable time was given to the consideration of this study, with reference to the valuable herbarium and collection of living plants at Hope Gardens. Knowledge of the Jamaica flora has been much increased during recent years through the collecting work of Mr. Harris and the study of specimens thus obtained by Professor Ignatius Urban, of the Berlin Botanical Garden, and others, while the expeditions sent on behalf of the New York Botanical Garden have also contributed materially. Very much more is therefore known about this flora than in 1893, when the Hon. Wm. Fawcett, late Director of Public Gardens and Plantations, published his "Provisional List of Jamaica Flowering Plants." We now propose to bring this knowledge into available form for general use by the publication of the work above mentioned, as a volume of "Memoirs of the New York Botanical Garden."

Some collecting was accomplished in the vicinity of Kingston and near Constant Spring, from August 28 to 30, but Spanish Town was made the first important base of operations, from August 30 to September 3, principally as the most convenient point for visits to the Healthshire Hills, a low and rocky range of considerable extent situated near the southern coast; we traversed them on foot in two directions, progress being slow and difficult on account of the extremely high temperature and great aridity, but were well rewarded by the discovery of several interesting shrubs and small trees.

A day was given to the study of the hills north of Spanish Town and the valley of the Rio Cobre below Bog Walk in search of the rare shrub *Bumelia Purdiei*, named in honor of William Purdie, a botanical collector who spent the years 1843–44 in Jamaica in the interests of the Royal Gardens at Kew, England; we failed to find it, but detected several other plants of interest.

Proceeding to Mandeville on September 3, four days were devoted to collecting in the Parish of Manchester, mostly at altitudes of 1,500 to 2,500 feet. The climate of this region is one of the most delightful in the West Indies, neither too warm nor too cold, too wet nor too dry. One of my objects in visiting this part of Jamaica was to secure living plants and herbarium specimens of two species of air-plants, bromeliads of the genus *Hohenbergia* growing mostly on the limbs of trees, found there some years ago by Mr. Harris and at that time new to science. I was desirous of increasing our collections of these remarkable plants, which have long narrow leaves growing in tufts, in appearance being something like a gigantic bird's-nest, the flowers borne in large clustered spikes on a long stalk arising from the middle of the tuft. Many kinds of these bromeliads grow in Jamaica and a considerable number are endemic there. We readily found the plants desired, as well as a third species; some fifteen different *Hohenbergias* are now known from Jamaica and we have specimens of all of them; at least six are new to science and will soon be technically described. Special attention was given during the entire trip to plants of this group, the Pineapple Family (Bromeliaceae), and in addition to the *Hohenbergias* most of the numerous species of the other large genera, *Tillandsia*, *Guzmania* and *Catopsis* were secured and one species each of *Bromelia*, *Aechmaea* and *Pitcairnia*. All these air-plants are known in Jamaica as "wild pines," the cultivated pineapple being called "pine"; inasmuch as there are no pine trees on the island, except some planted ones high up in the mountains, no serious confusion results in the application of the English name, which could not be used for these plants in the north temperate zone. The Garden's public collection of bromeliads is in conservatory house No. 2 and is a fairly representative exhibit, now to be materially augmented by plants obtained in Jamaica; many others grow in Cuba, Santo Domingo and in other parts of tropical America which I hope may be obtained by subsequent exploration.

Our collections in Manchester were extensive, including specimens of many characteristic trees and shrubs, among them the large-leaved little-known Plumier's grape-tree (*Coccolobis Plumieri*), found in ripe fruiting stage on a hillside at Mandeville; it is a relative of the sea grape or sea grape-tree (*Coccolobis uvifera*) a common tree of tropical American sea-coasts, extending northward to Florida and Bermuda, and like it has large clusters of edible fruits something like small plums, the branches resembling bunches of grapes.

During the years 1847 to 1849 the Moravian minister Henry R. Wullschlaegel was stationed in Jamaica; he was an enthusiastic botanical collector and discovered many plants new to science, some of which have not been found again, and are represented in collections only in Europe; much of his work, both pastoral and botanical, was done in Manchester; Fairfield was one of his stations, and there we went in search of some of the varieties discovered by him; we were hospitably received by Bishop A. Westphal who gave us information about the district, which has been almost completely cleared of natural woodland since the time of Wullschlaegel; a few small tracts of "bush land" still exist, but an examination of them did not reveal any of the desiderata at this point though some were subsequently found elsewhere. We were especially desirous of obtaining the little leafless ground orchid, named in his honor *Wullschlaegelia*, but our search was fruitless, and this still remains one of the rarest of Jamaican plants; most of the other orchids of the island, enumerating, large and small, some 180 species, are now represented in our collections, several additions having been made during this expedition; in the study of these plants I am grateful to Mr. Oakes Ames of North Easton, Massachusetts, for aid and information; he recently presented his valuable collection of living orchids to the Garden,* and this is of great assistance in our studies; I secured a number of duplicate specimens of orchids for his herbarium.

We returned to Kingston on September 7 and on September 9 made a new start by carriage to the mountains, our objective point being Cedar Hurst in the Parish of Portland, the road crossing the range at Hardware Gap at an altitude a little over 4,000 feet, and descending to Cedar Hurst at about 2,000 feet, the distance being about 32 miles; beautiful mountain scenery is had at

* See Journal New York Botanical Garden 8: 250. 1907.

the higher elevations and the drive to Hardware Gap and return to Kingston is one of the most interesting and enjoyable in the West Indies. I had traversed it in the spring of this year * and was glad of the opportunity to see the same vegetation in the autumn; we collected specimens of a number of species not found in the spring, including the endemic air-plant *Guzmania Fawcettii*, named in honor of the Hon. William Fawcett, late Director of Public Gardens and Plantations of Jamaica, and found first by Mr. Harris near Hardware Gap; it proved to be quite abundant in the vicinity. At Hardware Gap, as elsewhere in these mountains, a number of north temperate zone herbaceous plants are naturalized along the roadsides, including wild strawberries, buttercups, sorrel and dock, these existing there owing to the cool climate to which they are accustomed at home. Just beyond Hardware Gap five kinds of tree ferns grow plentifully near the road.

From Cedar Hurst we climbed up to Moody's Gap, at about 3,000 feet elevation. One of the most interesting plants found was the climbing aroid, *Philodendron tripartitum*, growing on banks and trees, its three-parted leaves somewhat resembling those of jack-in-the-pulpit of our own woodlands, a plant of the same family. I was glad to obtain this species for the collection of climbing aroids in conservatory house No. 4. Another conspicuous air-plant growing here is *Guzmania capituligera*, its large inflorescence bearing numerous small clusters of flowers. Many orchids were obtained and the region is rich in rare and interesting ferns and mosses, many species of which were collected. Two species of wild *Begonias* were abundant and beautiful; the flora of this region is very rich and diversified and more specimens were collected on this day than on any other of the trip; the rainfall here is high, but we were favored by perfect weather.

Returning again to Constant Spring Hotel on September 11, some time was given to the care of the collections and to further studies at Hope Gardens. On September 13 a visit was made to the Red Hills near Constant Spring, but the next important base of work was Bath, near the eastern end of the island, in the Parish

* See Journal New York Botanical Garden 9: 81. 1908.

of St. Thomas, which we reached by carriage on September 14, driving forty-four miles from Kingston; the excellent road runs along and near the southern coast; some collecting was accomplished at points on the way, but the long drive took most of the daylight.

Bath is situated in the valley of the Plantain Garden River, at an altitude somewhat above 100 feet and the climate is hot and wet. The hot sulphur springs, which gave the town its name, are in a lateral valley about a mile north of the town, and the baths there have long been esteemed. Bath is also noteworthy as the site of an old botanical garden where many valuable plants were first introduced into Jamaica, and which still contains many interesting exotic trees of large size. While here we were joined by the Hon. H. H. Cousins, Director of Agriculture, who came to inspect the old garden and to consider the availability of part of it as a nursery for cacao, the chocolate tree (*Theobroma cacao*), the cultivation of which is of increasing importance in the warm moist parts of Jamaica.

Our first collecting trip from Bath was to the Cuna Cuna Gap, through which passes the riding road over the mountains from Bath to Port Antonio; the gap is six and one half miles from Bath, at an elevation shown by the aneroid barometer to be about 2,400 feet; we traversed this road on foot and proceeded some two miles beyond the pass down the northern slope of the mountains, returning to Bath long after dark, favored by perfect weather until nightfall, when the rain caught us several miles out on the rough road and although protected by rubber coats we reached our lodgings in a somewhat bedraggled condition. But the experience of the day was well worth the wetting; the mountain views were beautiful, the temperature at the higher elevations delightful and the flora greatly diversified, containing many elements not familiar to us and we loaded a horse with interesting plants and specimens, including several rare species of the elegant shrubs and small trees of the Meadow Beauty Family (Melastomaceae), represented by many species in Jamaica. Mr. Harris detected a single plant of an orchid with a strikingly beautiful orange-colored flower growing on a tree trunk; it is quite unknown to us and must be very rare; the most diligent search of tree-trunks and rocks failed to reveal another of the same kind; the plant was preserved in formalin for Mr. Ames' examination.

One object in visiting Bath was to see the rare tree *Prioria copaifera*, definitely known to us to grow only in the vicinity of that place, although reported to occur also in Panama; it is locally known as oil-tree and gum-tree, its wood containing an inflammable heavy oil or liquid resin, which gives off dense black smoke when burned; it was discovered here before 1860 by Nathaniel Wison, for many years curator of the Bath Botanical Garden and a diligent collector who contributed much to the knowledge of Jamaica plants; its generic name commemorates the important botanical work of Dr. R. C. Alexander Prior in Jamaica. We failed to find it on the Cuna Cuna road. Mr. Harris had visited the district in search of this tree some years ago, and had found one at Mansfield, a short distance from the town. We therefore visited the estate, where we were cordially received by the owner, Mr. A. H. Groves, who kindly gave us permission to explore his woodlands. We made collections of many plants, including some fine orchids, but did not find the tree sought for. The valley of the Devil's River on this estate proved very interesting, but we were driven out by rain in the afternoon and could not explore it thoroughly.

The next day we again set out to find *Prioria*, going to Bachelor's Hall estate where it was first discovered by Wilson. After climbing over the foothills of the John Crow Mountain range all day, with only ordinary success, we were finally rewarded at dusk and again in the rain, by finding it in a valley at an altitude of about 600 feet. The tree is a magnificent one, forming a straight smooth cylindric trunk rising to at least 90 feet, the head of dark green foliage being oblong in outline. It was not in flower at the time, but we obtained specimens of the foliage from a young specimen and plenty of fruits and young seedlings on the ground under a large tree. The genus is of the Senna Family and has remarkable fruits, these being woody one-seeded, somewhat heart-shaped pods, about three inches across, the seed germinating inside the pod, which does not spilt open. Our walk this day indicated one apparently practicable way of reaching the top of the John Crow Mountain range, which has never been visited by botanists.* We reached, at one time, an elevation in the hills of some 1,300 feet, and had a close view of part of the main range; our guides pointed out a course which might be taken to reach the summit during dry weather, probably requiring camping only for two nights. It is probable that unknown plants exist at the higher elevations of this range, which runs nearly at right angles to the main mountain chain, and I hope that opportunity may come to explore these mountains before our study of the Jamaica flora is completed.

The last day at Bath was occupied by care of the collections, studies of the trees in the old botanical garden, a visit to the ravine above the baths and in attending an interesting meeting of the local branch of the Jamaica Agricultural Society, held to give the members an opportunity of meeting Mr. Cousins, Director of Agriculture. We drove back to Kingston on September 19, traversing the "inland road," which took us through some interesting hilly country where specimens of several species not seen by us before were collected. Near Serge Island we found the Jamaica wild grape-vine (*Vitis caribaea*) in full fruit, the vine climbing to the top of a tall tree, the small grapes of a rather pleasant flavor; we came out on the main coastal road at Belvidere and reached Constant Spring Hotel late in the evening.

Mr. Harris and I devoted September 21 to 23 to another trip to the Parish of Manchester, the base being the hotel at Bloomfield, very near Mandeville, and extensive collections were made in the country north and northwest of that town, driving one day well north of the railway to Grove Hill. We again failed to see the elusive little orchid *Wullschlaegelia*, but found some of the other interesting plants collected by Wullschlaegel. The best thing discovered is a species of *Dorstenia* detected by Mr. Harris growing on vertical limestone cliffs at Somerset. This peculiar genus of small herbaceous plants has leaves in tufts, and among them

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* See Journal New York Botanical Garden 7: 245. 1906.

the cluster of very small flowers borne on a nearly flat receptacle. It is included by botanists in the Mulberry Family on account of the technical characters of its flowers, but should, I think, be classified as a distinct natural family. The species found here has shield-shaped leaves and is new to the Jamaica flora, if not new to science; the other known Jamaica species, *Dorstenia cordifolia*, has heart-shaped leaves. Near Kendal I had the pleasure of seeing for the first time in bloom, the orchid *Epidendrum discoidale*, a stout large species with characteristic brownish flowers, and secured plants for growing.

We returned from Mandeville on September 24, driving through the parishes of Manchester and Clarendon some twenty miles to the railroad station at Four Paths. Between Clarendon Park and Four Paths we crossed some characteristic savanna lands at an elevation not over 200 feet above the sea; these are grassy plains interspersed with thickets, and an occasional pond, very dry at this time, but subject to flooding after heavy rains. Here we obtained specimens of several rare shrubs and herbaceous plants not previously seen by us, including the beautiful shining-leaved little tree *Mouriria*, of the Meadow Beauty Family. Next day the collections made during the whole trip were packed at Hope Gardens where they had accumulated. I am grateful to Mr. Cousins and Mr. Harris for aid in packing and shipping. Two general collections of ferns from various parts of the world contained in the herbarium at Hope Gardens but not needed there, were transferred by them to the New York Botanical Garden and formed part of the shipment. I had selected from our greenhouses before leaving New York, a large boxful of duplicate living plants for the Jamaica Department of Agriculture, and a number of duplicate herbarium specimens, the receipt of these ferns being thus in the nature of an exchange.

I sailed from Kingston on the "Atrato" September 26 and arrived in New York September 30, the collections coming on the same ship, except some of those made by Mrs. Britton. Living plants, seeds, fruits and herbarium specimens obtained during the expedition aggregate about 3,500 specimens and are important additions to our representation of the West Indian flora. The duplicates obtained will be used in exchange with other institutions. The expenses were defrayed by a generous contribution from Mr. D. O. Mills, president of the Board of Managers of the Garden.

Respectfully submitted,

N. L. Britton,
Director-in-Chief.

THE MUSEUM COLLECTIONS OF FLOWERING PLANTS.

The flowering plants of the museum collections fall into two distinct divisions, the public exhibit and the herbarium. The public exhibit is installed in the east hall and the east wing on the second floor of the museum building, except a block and a half of cases now standing in the west hall, while the herbarium is arranged in the main herbarium room situated on the top floor of the building.

Two distinct sections constitute the public exhibit: first, the Local Flora, a collection of specimens representing the plants growing without cultivation within a radius of one hundred miles of New York City, is displayed in the swinging frames borne on standards placed between the large exhibition cases. Each stand displays at least ninety-six representatives from the area concerned. The specimens are each provided with a label giving the common name, the plant name, the habitat, and the distribution of the species. Most of the species occurring within the one hundred mile radius referred to are now installed and labelled.

In the second section of the public exhibit, called the Synoptic Collection, the flowering plants are arranged on a system showing their relationship by families, beginning with the more simply organized groups and ending with the more highly organized. Characteristic specimens represent each plant family. The specimens are supplemented by plates or drawings which stand beside each specimen at the back of the case, while on the shelves in front of the plates and specimens are shown objects, mainly parts of plants from related species or genera, such as bark, leaves, flowers, fruits, woods and fossil remains.

The collection of flowerless plants was described in the June number of the JOURNAL for 1901. As compared with the four subkingdoms of the flowerless plants, the flowering plants comprise a single subkingdom, technically called the Spermatophyta, or the seed-bearing plants. However, this single subkingdom divides into two sharply defined groups, namely, the cone-bearing plants, or Gymnosperms, represented by the conifers, or the shrubs and trees commonly called evergreens, and the fruit-bearing plants, or the Angiosperms, represented by the herbaceous vegetation and the deciduous-leaved shrubs and trees.

Like their relatives, the higher group of flowerless plants, the cone-bearing plants in an early geological age were the more prominent seed-bearing representatives of the vegetable kingdom, but in a later age, as in the present one, the cone-bearing plants apparently began to decrease and the fruit-bearing plants came to predominate; consequently the present representatives of the cone-bearing plants may be considered a remnant of a once dominant group in the plant kingdom.

The herbarium was described in the March number of this JOURNAL for 1900. At the time that description appeared all the herbarium specimens at the Garden, of both the flowerless and flowering plants, were arranged in the main herbarium room referred to in a former paragraph. Now a half dozen other rooms on the top floor of the Museum Building are devoted in whole or in part to the flowerless plants, while the flowering plants alone occupy the cases in the main herbarium room. The growth of the herbarium has resulted in about an equal division of the two main groups of plants as far as the case room they occupy is concerned, the flowerless and the flowering plants each occupying cases with a total of over five thousand pigeon holes, while fruits and seeds and other objects too bulky to be placed on herbarium sheets are contained in cabinets at the southern end of the herbarium room.

The herbarium of flowering plants is made up of the herbarium of Columbia University, including the Torrey Herbarium, the Meissner Herbarium, and the Chapman Herbarium, together with miscellaneous sets of specimens, and the Garden

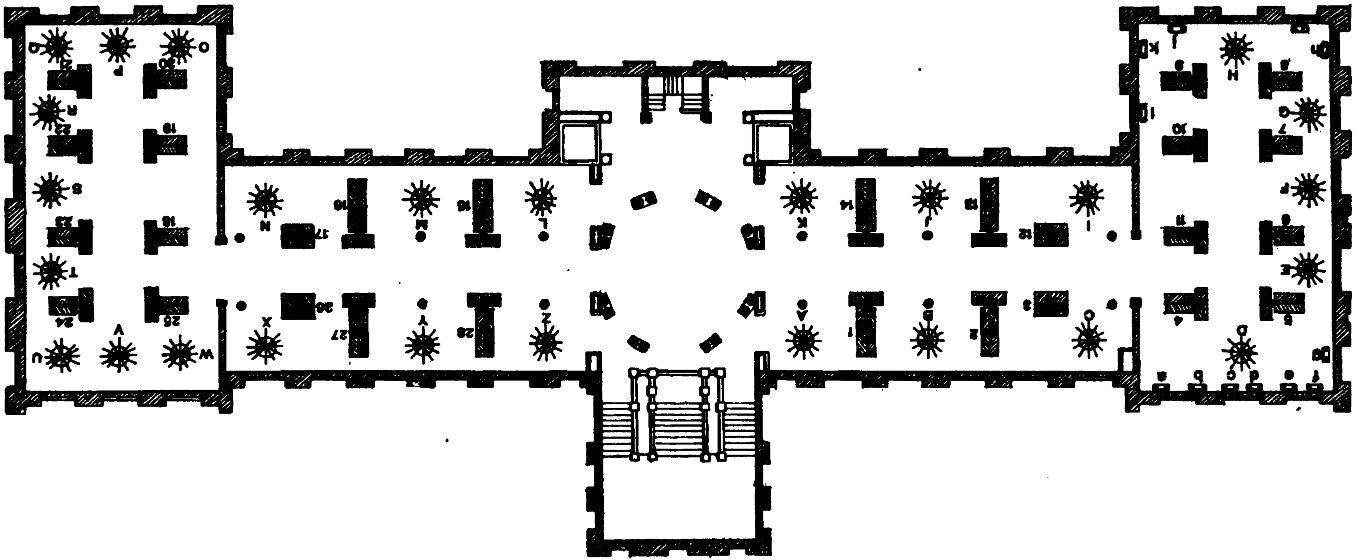


FIG. 29. Floor-plan of the museum of systematic botany. The flowering plants of the Local Flora are displayed in stands *L–Z*; the Synoptic Collection occupies blocks *14–28*.

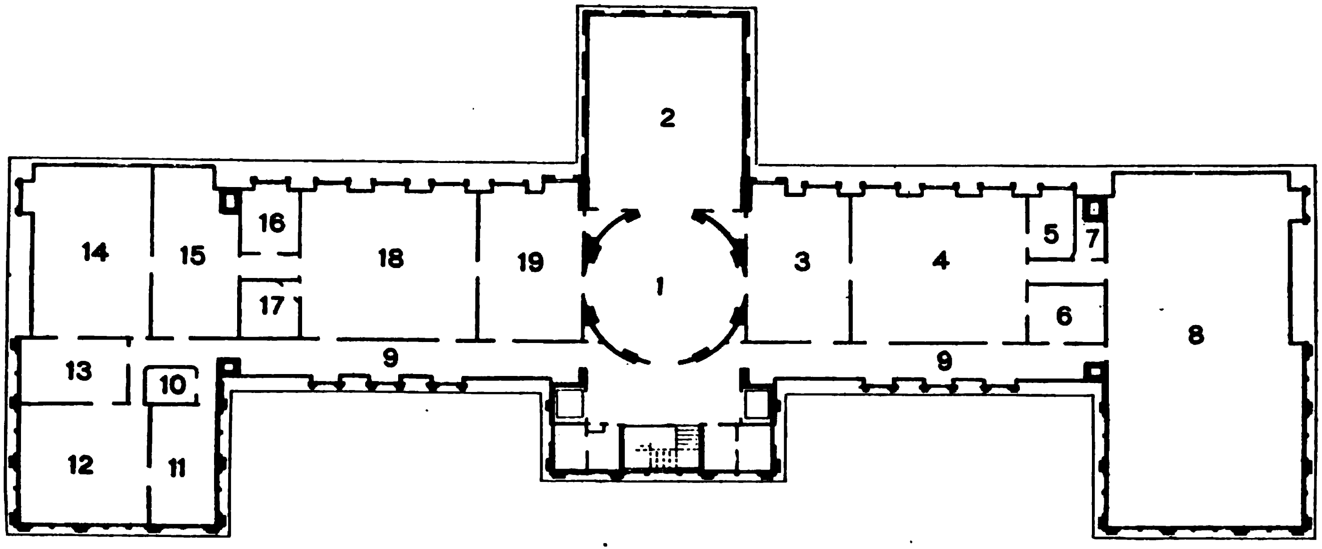


FIG. 30. Plan of upper floor of museum building. 4. Herbarium of Ferns. 6. Herbarium of Mosses. 8. Herbarium of Flowering Plants. 14. Herbarium of Fungi. 18. Herbarium of Seaweeds and Liverworts.

Herbarium, including over twenty-five individually formed herbaria of considerable size, and several smaller herbaria, and miscellaneous sets of plants. The collection is especially rich in specimens from all parts of the North American mainland, the West Indies, South America, Europe, China, the Philippines, and Australia, together with a fair representation of the vegetation of other parts of the world.

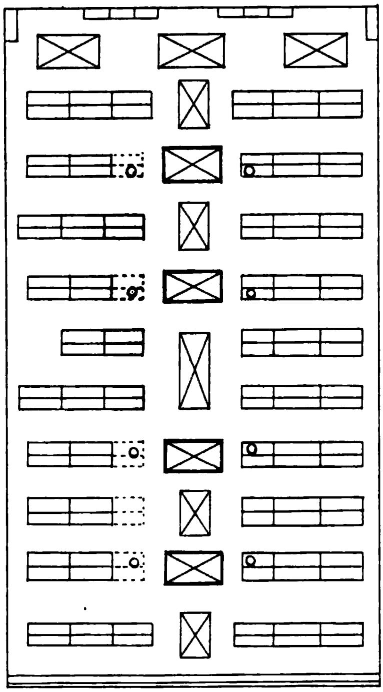


FIG. 31. Floor-plan of the herbarium of flowering plants. Compare Fig. 7 in the JOURNAL for March, 1900. Dotted lines represent cases not yet installed, See frontispiece for style of cases, cabinets and tables.

The importance of the Columbia herbarium, in addition to the specific elements referred to above, lies largely in the great bulk and variety of material brought together and preserved by Dr. Torrey while he maintained the center of botanical activity in North America. That period was conspicuously productive both of individuals interested in botany and of lasting botanical achievement. During the first half of the nineteenth century, the limited but well-settled area of the United States was apparently more evenly furnished with men interested in plants and their distribution than at any period before or since. Professional men, business men and army officers in all parts of eastern North America sent their specimens to Dr. Torrey; while the collections made on many of the expeditions sent to explore the yet unknown portion of the West came to him for study. Dr. Torrey's successors lost no opportunity to increase the value and usefulness of the original foundation and accumulated much important material by means of exploration, exchange and purchase.

The Garden and the Columbia herbaria supplement each other as well as any two separately formed collections could. The consolidation of the herbaria cited in the following list may be considered the foundation of the Garden herbarium:

The J. J. Crooke herbarium — North American mainland, West Indies and Pacific Ocean regions.

The F. M. Hexamer herbarium — North American mainland and Europe.

The H. E. Hasse herbarium — Central and western United States, Mexico and Greenland.

The P. A. Rydberg herbarium — Western United States and Sweden.

The L. R. Gibbes herbarium — Southeastern United States.

The P. V. LeRoy herbarium — North American mainland, West Indies and Europe.

The H. Edwards herbarium — North American mainland, chiefly California, and Australia.

The A. M. Vail herbarium — Eastern United States.

The F. E. Lloyd herbarium — Pacific slope and eastern North America.

The O. R. Willis herbarium — Eastern United States.

The F. S. Earle herbarium — North American mainland, especially the south and the west.

The W. A. Murrill herbarium — Eastern United States.

The E. G. Britton herbarium — Eastern North America.

The L. T. Chamberlain herbarium — North American mainland, especially California and the northeastern United States.

The E. C. Howe herbarium — Eastern United States.

The A. Vigener herbarium — Mexico and Europe.

The A. Henry herbarium — China.

The O. Kuntze herbarium — West Indies, Central and South America and Old World.

The American Museum of Natural History herbarium — United States, Central America and Old World.

The Torrey Botanical Club herbarium — Region within one hundred miles of New York City.

Some specimens of flowering plants were also contained in the following herbaria which constitute a large portion of the collections of flowerless plants :

The J. B. Ellis herbarium.

The C. L. Anderson herbarium.

The N. Pike herbarium.

The J. S. Billings herbarium.

The L. M. Underwood herbarium.

The G. S. Jenman herbarium.

The T. F. Allen herbarium.

The W. Mitten herbarium.

The G. Massee herbarium.

These, with two other large elements, constitute the Garden herbarium at present. First, many sets of plants from portions of North America, South America and the Old World which were imperfectly known or could not be explored during the period of greater botanical activity at Columbia. Second, the material secured by collectors on journeys of exploration maintained by the Garden on the American mainland, the West Indies and the Philippine Islands.

J. K. Small,
Head Curator.

DR. GAGER'S NEW POSITION.

At the meeting of the scientific directors of the Garden, held June 13, 1908, the following letter was received from Dr. C. Stuart Gager, Director of the Laboratories:

5 June, 1908.

DR. N. L. BRITTON,
Director-in-Chief, New York Botanical Garden.

Dear Sir: On the 30 of May I received notice of my appointment as Professor of Botany in the University of Missouri.

A realization of the unusual opportunities of my present position, and a full appreciation of the congenial circumstances and harmony that have marked my official relations here, have not made it easy for me to decide to accept this new appointment.

For several reasons, however, I feel that I ought not to decline: I have forwarded my acceptance to the executive committee of the university, and beg to present herewith my resignation as director of the laboratories of the New York Botanical Garden, to take effect on August 31, 1908.

It will be difficult to terminate by that time some investigations now in progress, and I will esteem it a great favor if I may have the privileges of the laboratories and the experimental garden until this work can be brought to a close during the coming autumn.

Very sincerely yours,
(*signed*) C. STUART GAGER,
Director of the Laboratories.

This resignation of Dr. Gager was received with regret, and his valuable services to the Garden and to botanical science were discussed. The resignation was accepted and the chairman was requested to write Dr. Gager a letter expressing the appreciation of the scientific directors of his services while occupying the position of director of the laboratories.

A copy of the letter written by the chairman of the scientific directors is as follows:

July 6, 1908.

DR. C. STUART GAGER,

Director of the Laboratories.

Dear Dr. Gager: The board of scientific directors, in accepting your resignation, have instructed me to express their great regret at the necessity for doing so, and to write to you a letter expressing their appreciation of your services while occupying this position.

In carrying out these instructions, it gives me pleasure to say that your services both as an instructor of those who have studied under you and as an original investigator have been, without exception, highly satisfactory.

Your personal qualities have endeared you to all the members of the garden staff who have been brought into close relations with you, and you will carry with you our high personal esteem, as well as our official approval. Not the least among our feelings of regret is that in connection with the loss that the scientific interests of this city and locality will suffer through your removal. At the same time, we heartily congratulate Missouri upon its good fortune, and trust that you will continue to feel bound to us by mutual interest in your work and by the ties of good fellowship.

Sincerely yours,

(*signed*) H. H. RUSBY,

Chairman.

Dr. Gager was appointed director of the laboratories of the Garden in 1906 and commenced work in that capacity in February of that year. While occupying the position he has directed the work of many students and has carried on noteworthy investigations in plant physiology and plant cytology. His principal literary production during this period is his account of his extended experiments with radium on the growth of plants, which is now being printed as the third volume of Memoirs of the Garden.

THE NEWLY APPOINTED DIRECTOR OF THE LABORATORIES.

In filling the position of director of the laboratories, made vacant by the resignation of Dr. Gager to accept the professorship of botany in the University of Missouri, the scientific directors, at their meeting on June 13, considered the subject in all its bearings and concluded that it would be most desirable for much of the Garden's work to secure a plant pathologist; Professor Fred J. Seaver, of the North Dakota Agricultural College, was invited to accept the post, which he subsequently did, and reported for duty early in September. Mr. Seaver graduated from Morningside College in 1902, and subsequently studied as a university scholar in botany at the State University of Iowa, and served as a special assistant to Dr. J. C. Arthur at Purdue University. He held a fellowship in botany at the State University of Iowa during 1903 and 1904, where he received the degree of master of science; he held a Columbia University fellowship in botany in 1906 and 1907, and carried on investigations at the New York Botanical Garden during that period. He was a botanical assistant at the University of Iowa in 1904 and 1905, instructor in biology in Iowa Wesleyan University, 1905–1906, and has recently been assistant professor of botany in the North Dakota Agricultural College. Mr. Seaver's original investigations have been upon certain groups of minute fungi parasitic on living plants and this knowledge will be of great advantage to us in the cultural work of the Garden. Mr. Seaver will also prepare some of the monographs of groups of fungi for "North American Flora," in addition to his regular work of supervising the work of students.

NOTES, NEWS AND COMMENT.

The autumn course of lectures to the 4 B and 5 B grades of the public schools of the Bronx, comprising fifteen lectures with accompanying demonstrations, began October 6 and will be concluded in November. The total attendance of pupils and teachers at these exercises will reach twelve thousand.

The entire collection of Boletaceae in the herbarium of Cornell University has recently been sent to the Garden for critical examination. This collection contains valuable material from Alabama, North Carolina, the Adirondacks, the Cayuga Lake Basin, Nova Scotia, Ohio, Michigan, and elsewhere, mostly collected by Professor Atkinson or his associates. A number of duplicate specimens have been presented to the Garden.

Gray's New Manual of Botany has recently appeared in its seventh edition, prepared by Professors B. L. Robinson and M. L. Fernald of Harvard University, with the collaboration of other specialists.

A field meeting of the members of the Department of Botany of the Brooklyn Institute of Arts and Sciences was held at the Garden on the afternoon of Saturday, October 3, over forty ladies and gentlemen being in attendance. They were received by Dr. Britton, who spent the afternoon with them, describing the collection of shrubs (fruticetum), and they were subsequently escorted through other parts of the grounds and the public conservatories by Mr. Wilson.

Meteorology for September. — Total precipitation recorded for September 1.42 inches. Maximum temperatures were recorded of 84° on the 2d, 85° on the 9th and 11th, 86° on the 19th and 81° on the 25th; also minimum temperatures of 46.5° on the 4th, 49° on the 8th, 46.5° on the 16th, 56.5° on the 22d and 41° on the 29th. The mean temperature for the month was 63.5°.

ACCESSIONS.

LIBRARY ACCESSIONS FROM SEPTEMBER 1 TO SEPTEMBER 30, 1908.

EULER, HANS. *Grundlagen und Ergebnisse der Pflanzenchemie.* Erster Teil. Braunschweig, 1908.

FISCHER, JULIUS. *Die Lebensvorgänge in Pflanzen und Tieren.* Berlin, 1908.

FRANCÉ, RAOUL H. *Die Lichtsinnesorgane der Algen.* Stuttgart, 1908.

HALLIER, HANS. *Über Juliania, eine Terebinthaceen-Gattung mit Cupula.* . . . Dresden, 1908.

HOUARD, CLODOMIR. *Les zoocécidies des plantes d'Europe et du bassin de la Mediterranée.* . . . Tome Premier. Paris, 1908.

KLINICKSIECK, PAUL & VALETTE, TH. *Code des couleurs.* . . . Paris, 1908.

MIGULA, WALTHER. *Pflanzenbiologie.* Leipzig, 1909 (1908).

VICKERS, ANNA. *Phycologia Barbadensis.* Paris, 1908.

MUSEUMS AND HERBARIUM.

175 specimens of fungi from New York City. (Collected by Dr. W. A. Murrill.)

133 specimens of fungi from New Orleans, Louisiana. (Given by Mr. F. S. Earle.)

106 specimens of flowering plants from Africa. (By exchange with the Royal Gardens, Kew, England.)

100 specimens "Kryptogamae Exsiccatae," Cent. XIV, for the Columbia Herbarium. (By exchange with the Natural History Museum, Vienna, Austria.)

2 specimens of Rutaceae from Lower California. (Given by Mr. T. S. Brandegee.)

34 specimens of hepatics from Mexico, Panama and Colombia. (Distributed by Mr. F. Renauld.)

PLANTS AND SEEDS.

78 plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

2 ferns for herbaceous collection. (Given by Mr. R. C. Benedict.)

3 plants of *Fragaria* for herbaceous collection. (Collected by Dr. P. A. Rydberg.)

30 plants for the herbaceous collections. (Collected in the vicinity.)

1 plant of *Epidendrum* for conservatories. (Given by Mr. D. T. Darnolt.)

1 plant of *Haemanthus* for conservatories. (Given by Mrs. W. H. Harrison.)

7 palms for conservatories. (Given by Mrs. P. L. vonHemert.)

16 plants from Mexico for conservatories. (Given by Dr. F. E. Lloyd.)

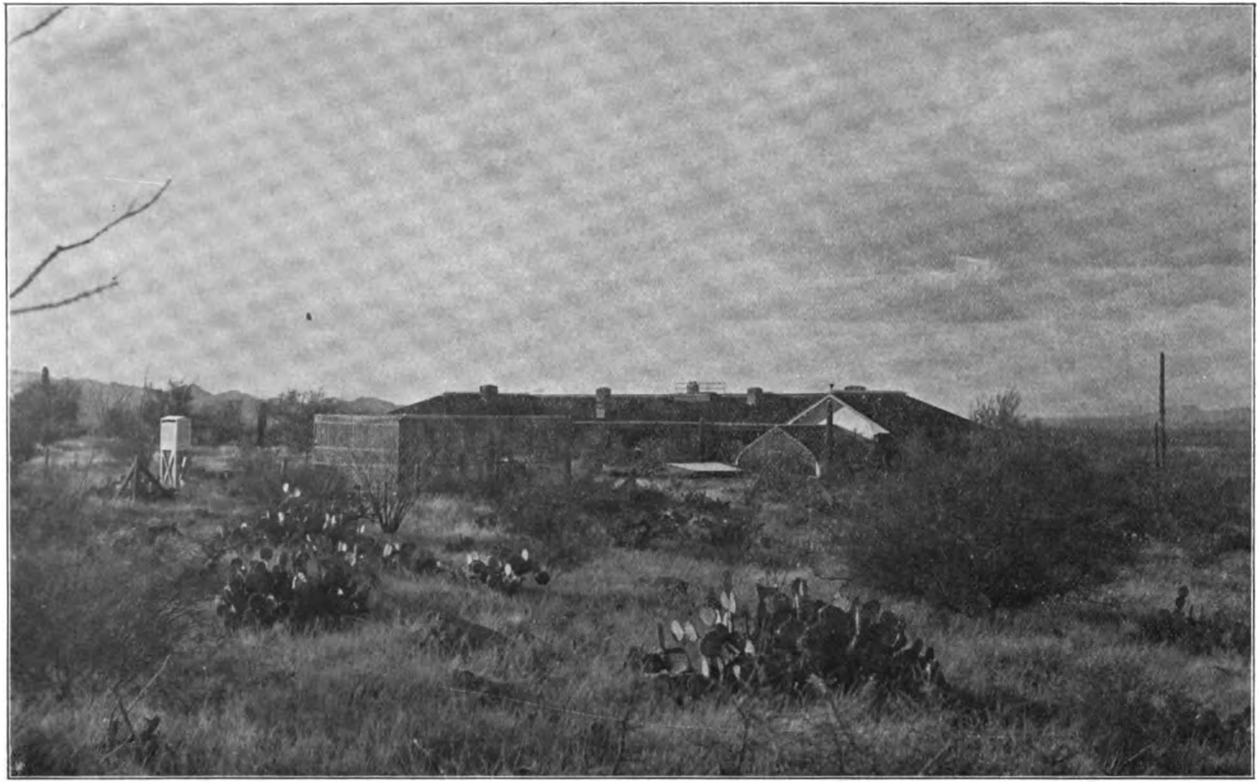
2 plants for conservatories. (Given by Mr. F. F. vonWilmowsky.)

2 packets of *Crataegus* seed. (Given by Mr. B. F. Bush.)

1 packet of *Thalictrum* seed for herbaceous collection. (Given by Mr. E. S. Steele.)

1 packet of seed from Mexico. (Given by Dr. H. H. Rusby.)

24 plants derived from seed from various sources.



Courtesy of the Carnegie Institution of Washington.

THE DESERT LABORATORY AT TUCSON, ARIZONA, PHOTOGRAPHED NOVEMBER 10, 1908, WITH SEVERAL SPECIMENS OF CARNEGIEA GIGANTEA.

JOURNAL

OF

The New York Botanical Garden

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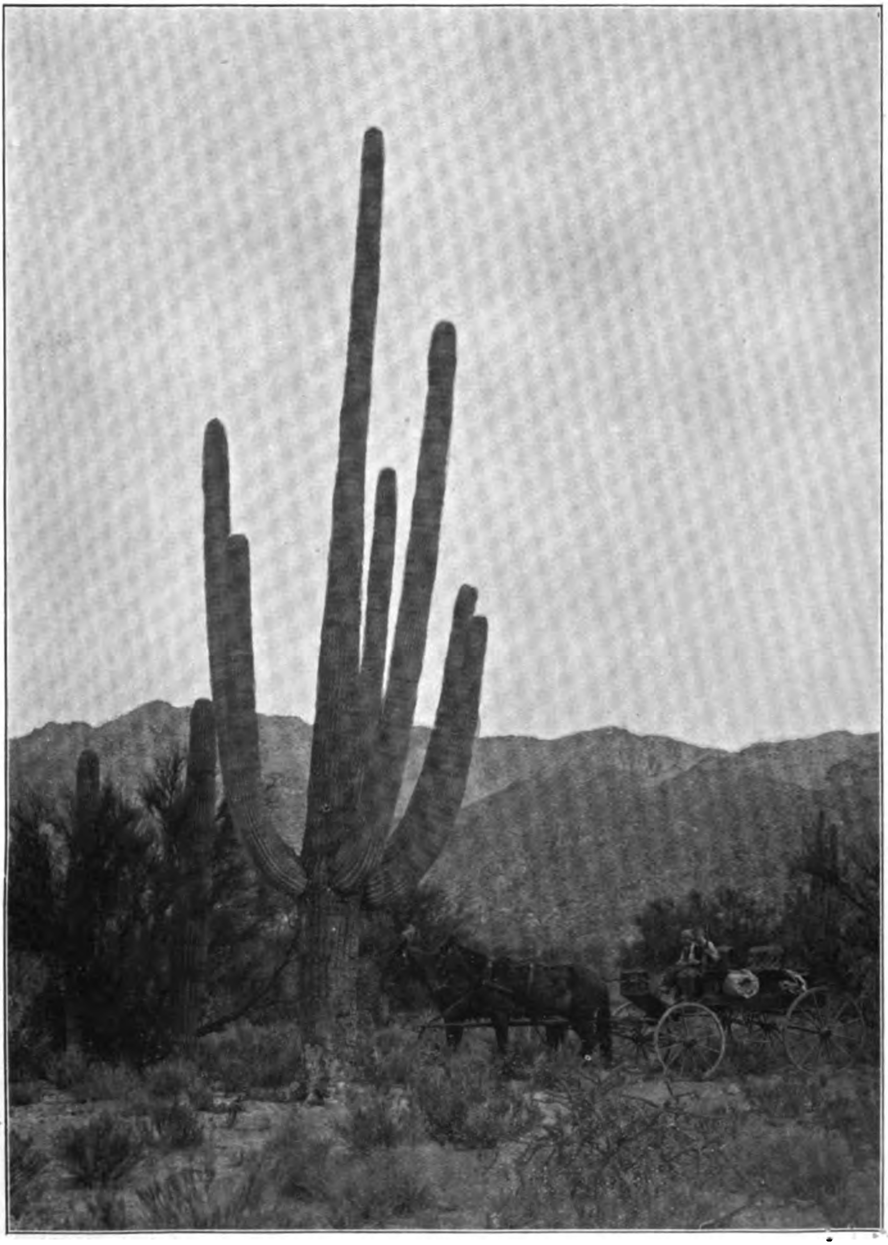
A NEW GENUS OF CACTACEAE.

The gigantic cactus of Arizona and adjacent regions, known in its home by the common name sahuaro, is one of the most remarkable of plants and the most striking element in the desert vegetation of the southwest. As pointed out by Dr. D. T. MacDougal, it was probably first observed by Europeans about 1540, when the expedition of Coronado passed through the region which it inhabits; Onate in 1604 passed through the valley of the Bill Williams Fork of the Colorado River in Arizona and noted the plant, and his account is probably the earliest printed record of it (see Journn. N. Y. Bot. Gard. **6**: 129–130). While known to earlier explorers from the Atlantic seaboard, the first specimens of this interesting plant were collected on the expedition of Lieut. W. H. Emory, a military reconnoissance from Fort Leavenworth in Missouri to San Diego in California, during the autumn of 1846, and the plant is frequently referred to in his report. These specimens were sent to Dr. George Engelmann at St. Louis and after a study of them he gave this cactus the botanical name *Cereus giganteus*.

The plant grows on hillsides in southern Arizona, southeastern California and northern and central Sonora, sometimes reaching a height of sixty feet, branching at from twelve to twenty feet above the ground. Travelers through these regions are always impressed by its very unusual form, and many thousands of people have become familiar with it since three plants were brought to the New York Botanical Garden by Dr. MacDougal in the spring of 1902, where they have since been successfully maintained, flowering every year in late spring and early summer (Journ. N. Y. Bot. Gard. **3**: 96–98). During our study of the North American Cactaceae, which has now extended over several years, the species included by previous students in the genus *Cereus* have been critically examined; most of them have been seen in the living state, and living specimens are now in the conservatories of the New York Botanical Garden, and in those of the United States Department of Agriculture at Washington. As these specimens have come into flower from time to time it has become increasingly evident that the conception of the genus *Cereus* by previous authors has been altogether too broad. This was inferred at the outset of the investigation from a study of the published descriptions and illustrations, and from the fact that the plant-body of species of *Cereus* ranges all the way from slender climbing vines and low tufted plants, up to the magnificent and stately proportions of the sahuaro and of the other gigantic species which inhabit southern Mexico. The type species of *Cereus* is *Cereus peruvianus* Miller, a night-blooming species native of South America, fine large specimens of which may also be seen in the conservatories of the Garden. Some genera have already been suggested as distinct from *Cereus* by one author or another.

The most noteworthy recent study of these plants has been by Mr. Alwin Berger, gardener at the late Sir Thomas Hanbury's famous home at La Mortola, Italy, entitled "A Systematic Revision of the Genus *Cereus* Miller" (Report Mo. Bot. Gard. **16**: 57–86. 1905), which is a great improvement over the preceding discussion of these plants by the late Professor Karl Schumann (Gesamtbeschreibung der Kakteen, ed. 2, 1903), inasmuch as Mr. Berger first definitely groups most of the species into subgenera, more or less well-defined by floral and fruit characters; whereas Professor Schumann was obliged to group them only in series, many of these being very unnatural, and based almost wholly on the plant-body instead of on the inflorescence. Mr. Berger's contribution is a noteworthy advance, and we find ourselves largely in accord with his groupings of the plants, although there are some results in which we are obliged to differ with him,



Courtesy of the Carnegie Institution of Washington.

SPECIMEN OF CARNEGIEA GIGANTEA OF MAXIMUM SIZE, NEAR AGUA CALIENTE, ARIZONA, ON THE SLOPES OF THE CATALINA MOUNTAINS, PHOTOGRAPHED MARCH 25, 1908.

Courtesy of the Carnegie Institution of Washington.

Flowers, Buds and Fruits of Carnegiea gigantea. On one flower are to be seen two bees which are instrumental in pollination.

reached mainly from a more complete knowledge of flowers and fruits. Dr. Engelmann in his Synopsis of the Cactaceae of the United States (Proc. Amer. Acad. **3**: 260–346. 1856) had earlier indicated some subgenera and had recognized *Cereus giganteus* as belonging to one of these, which he called *Lepidocercus*, a name which it is neither necessary nor desirable to main-

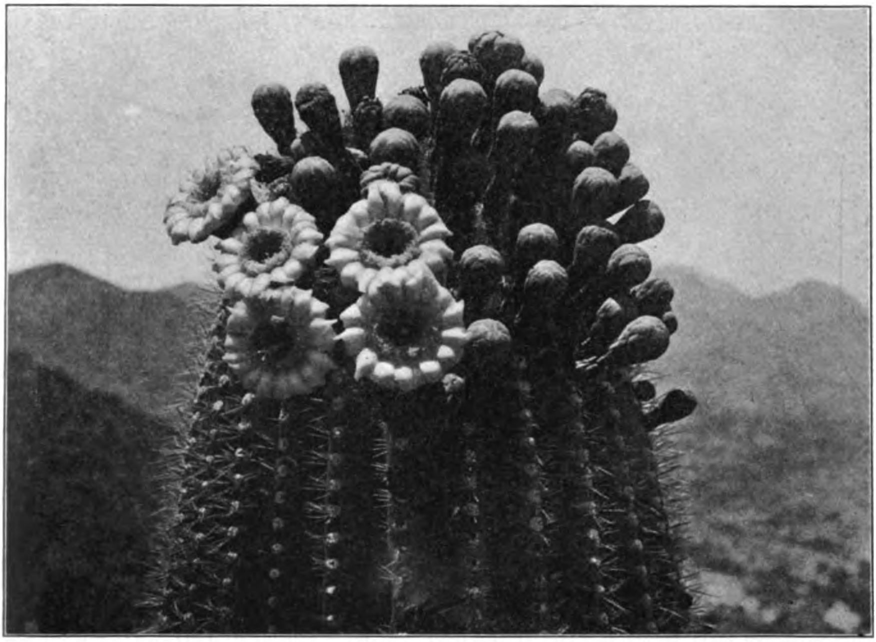


FIG. 32. Cluster of flowers at apex of stem of *Carnegiea gigantea* growing near Tucson, Arizona.

tain; he also included in this subgenus *C. Thurberi* Engelm., native of Sonora and Arizona, which we now know should be excluded, leaving only the sahuaro in the genus which we here propose under the name

CARNEGIEA.

A day-blooming cactus, with stout upright stems and few branches, or none, strongly ribbed, the areoles velvety, close together, and bearing 12–18 spines. Flowers borne at the areoles near the top of the stem and branches, funnelform, the tube nearly cylindric, about half as long as the limb, bearing a few broadly triangular-ovate acute scales with tufts of wool in their axils; petals white, short, widely spreading and somewhat reflexed when fully expanded; ovary spineless, oblong, with similar scales somewhat closer together; stamens very numerous, about three-quarters as long as the petals; stigmas 12–18, narrowly linear, reaching a little above the stamens; fruit an oblong or somewhat obovoid berry with small distinct scales, its pulp red, the seeds very small, numerous, black and shining. The genus consists only of the species.

Carnegiea gigantea (Engelm.).

Cereus giganteus Engelm. Rept. Emory's Recon. 159. 1848.

The genus is dedicated to Mr. Andrew Carnegie. The Desert Laboratory of the Carnegie Institution of Washington, at Tucson, Arizona, is surrounded by typical specimens of this unique plant.

N. L. BRITTON,
J. N. ROSE.

LETCHWORTH PARK AND THE FALLS OF THE GENESEE.*

The Genesee River rises in the northern part of Pennsylvania, in the Allegheny plateau, and during its course of one hundred and twenty-three miles in the state of New York it has a fall of fifteen hundred and fifty-three feet, finally emptying into Lake Ontario at Rochester. This river is unique in two particulars: It is the only river in New York which flows entirely across the state; and it is the only river crossing the southern boundary which flows to the north. For a part of its course it forms the boundary line between the counties of Wyoming and Livingston, and it is to a short distance of this boundary portion, some three miles in length, that I wish to call your attention. Here, in a strife which was begun in ages past, but which is still continued between the waters and the land, this river has cut for itself a deep bed, known as the Portage or Glen Iris gorge, and in this short three miles is comprised some of the most striking and magnificent scenery in the eastern United States, being second only to

* From a lecture delivered at the New York Botanical Garden, October 31, 1908.

The Desert Laboratory at Tucson, Arizona, as it appeared several years ago. Two plants of Carnegiea gigantea are conspicuous in the foreground.

SPECIMENS OF CARNEGIEA GIGANTEA COLLECTED NEAR TUCSON, ARIZONA, IN 1902, IN BLOOM IN THE CONSERVATORIES OF THE NEW YORK BOTANICAL GARDEN.

that of Niagara, which, though more imposing and on a grander scale, must perhaps give way in some respects to its smaller rival.

To this place, about the middle of the last century, was attracted a gentleman destined to be one of the great men of New York — a man of deep charity and broad human interest — a descendant from sturdy Quaker stock. This man is the Hon. William Pryor Letchworth, for a long time a member of the state board of charities, and for many years its president. A gentleman of the old school, courteous and kindly, with an open hospitality which makes the guest feel at once at home, and with a broad human sympathy which embraces all mankind — to know this gentleman is indeed a privilege.

To this man the state, the nation too, owes a debt of gratitude, for to his generosity the people of the country are indebted for a gift of almost priceless value. As will be shown in detail below, Mr. Letchworth has given to the state of New York, for all time, the beautiful tract of land, containing over one thousand acres, now known as Letchworth Park, including within its confines all three of the falls of the upper Genesee.

It was in 1859, about two years after the Hon. Andrew H. Green, a kindred spirit, had begun improvements in our own Central Park, that Mr. Letchworth made his first purchase of land along the Genesee. From time to time since then he has made additions to this original acquisition, until now, as stated above, the tract comprises over one thousand acres, and upon its acquisition and improvement there have been expended by Mr. Letchworth over five hundred thousand dollars. At the time of its purchase it had been devastated by lumbermen, and the tract was littered with only such refuse as a lumberman, in his greed for gain, can make — old limbs and branches, rotting logs, chips and stumps. All vestiges of these have been removed and in their place have appeared stretches of new timber, carefully preserved, and paths and driveways affording access to the beauties of nature here so lavishly displayed.

From its very inception, Mr. Letchworth has designed his estate as a public park, and the public has at all times been welcome to it. The immediate surroundings of his home have been restricted, but to all other parts visitors have had free access. His home is known as Glen Iris, a name early conferred upon it by Mr. Letchworth, suggested by the beautiful rainbows which form constantly on bright days in the mists which rise from the middle fall.

From a private park, private only in the sense that it belonged to a private citizen, it was but a step to the broader outlook of a public park, and eventually we find Mr. Letchworth seriously considering the step to which I have already alluded — its free gift to the state as a public park or reservation. A committee of influential men was appointed, and after consultation with them this step was taken. On December 14, 1906, this committee called on Governor Hughes, explaining their mission, and it is said that he responded as follows: "In the midst of so many calls from people who are asking for something *from* the state, it is a novel and delightful sensation to have some one offer to give something *to* the state. This is certainly a most generous benefaction." On January 10, 1907, a bill was introduced into the legislature providing for the acceptance of this gift. A week later the assembly passed this unanimously, but in the senate opposition developed. An amended bill was there proposed, but, on the insistence of Mr. Letchworth, the original bill was finally passed by that body on the twenty-third with but four opposing votes, and on the twenty-fourth it became a law by the addition of the governor's signature.

The bill provides that "the land therein conveyed shall be forever dedicated to the purpose of a public park or reservation, subject only to the life use and tenancy of said William Pryor Letchworth, who shall have the right to make changes and improvements thereon." The bill also provides that after the death of the donor, control and jurisdiction of the tract shall be in the hands of the American Scenic and Historic Preservation Society, of which Mr. J. Pierpont Morgan is honorary president, and Mr. Geo. F. Kunz, the noted gem expert, president, thus placing it in safe hands. Early in February the senate and assembly adopted a concurrent resolution conferring the name of Letchworth Park upon this tract in honor of its donor.

That this park might be made of even greater service to the public, by emphasizing its educational side, Mr. Letchworth wished to have a study made of the arboreal vegetation in the park and the trees properly labelled. Dr. N. L. Britton, the Director-in-Chief of the Garden, was consulted in this matter, with the result that I was selected to visit the park and consult with Mr. Letchworth in reference to this. My first visit was made in the fall of 1907, and a sample of the label used on the trees in the New York Botanical Garden was submitted. Mr. Letchworth approved of this, and during July of the present year I made a second visit for the purpose of superintending the affixing of a number of labels of this type.

With this brief account of the history of Letchworth Park, I wish now to describe to you, with the aid of a few illustrations, some of its beauties and points of interest. A reference to the accompanying map will help make clear the positions of the various places mentioned.

From New York City the region is reached most conveniently by the Erie railroad. Leaving the train at Portage, which is on the Livingston county side of the river, a short walk brings us to the long viaduct, upon which the railroad crosses the Genesee. From the middle of this structure, which is two hundred and thirty-four feet above the level of the river, a magnificent view of the Genesee gorge may be had. Before us to the north, as far as the eye can see, lies a beautiful panorama of undulating hills and forest stretches, with the gorge and river winding like a narrow ribbon to the north. About five hundred feet from the viaduct the Genesee takes its first plunge, a cloud of spray and rising mists marking the position of the chasm into which the river leaps. This is known as the upper fall. Away to the northeast, about twenty-one hundred feet beyond the upper fall, another cloud of mist and spray reveals the spot where the river takes its second plunge, this being known as the middle fall. It is but a few hundred feet from this, on the left bank of the stream, that the residence of Mr. Letchworth is located. Between this and the third and last fall, out of view beyond the distant bend, lies the picturesque gorge of the Genesee.

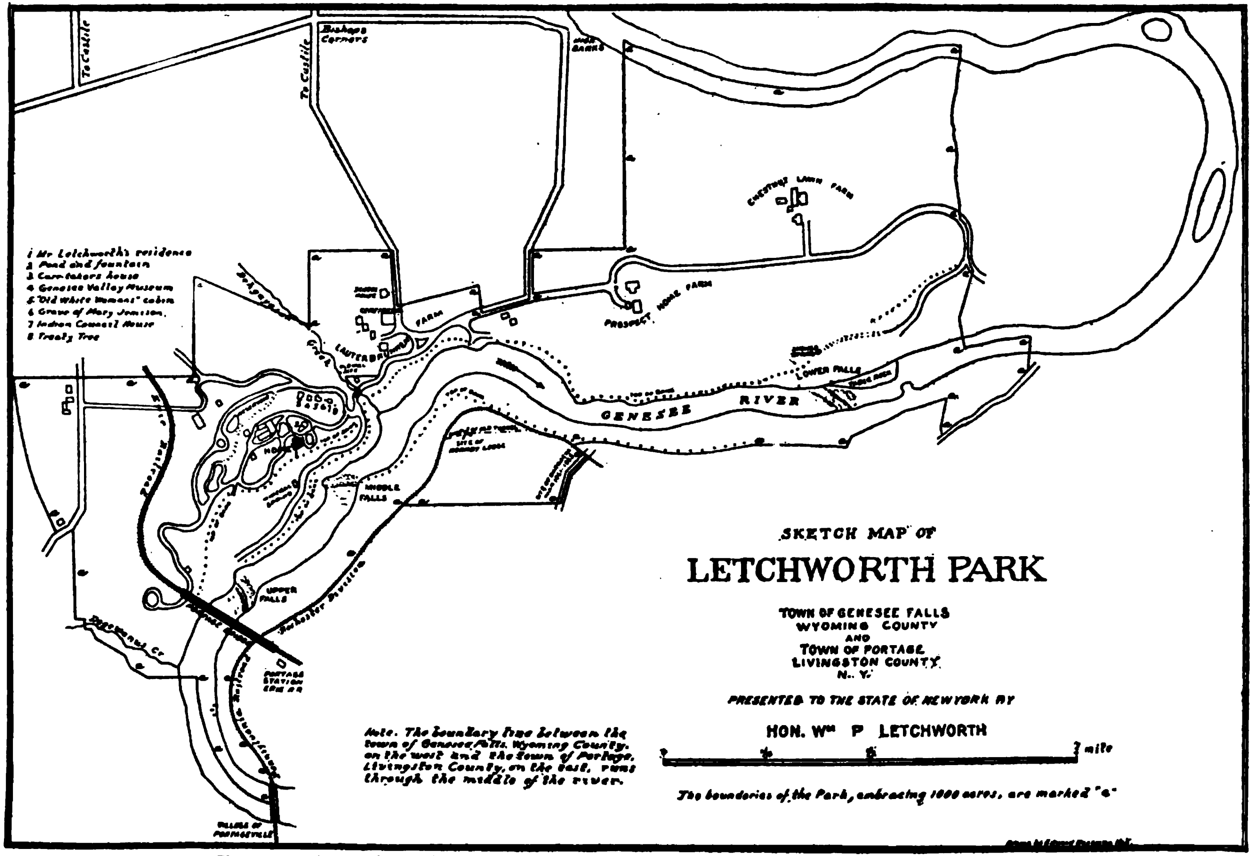


FIG. 33. Map of Letchworth Park. (From Rept. Amer. Scen. and Hist. Preserv. Soc.)

At the further end of the bridge will be found a series of steps and galleries which will conduct us to the vicinity of the upper fall. About half way down these we come to the falls of the De-ge-wa-nus, a small stream which empties into the Genesee at this point, and a little later to the picnic grounds. Here tables and benches have been provided for visitors, and hitching posts for horses, for many people drive from the surrounding country to see these falls. At this point glimpses may be had of the upper fall, but if one really wants to enjoy its grandeur,

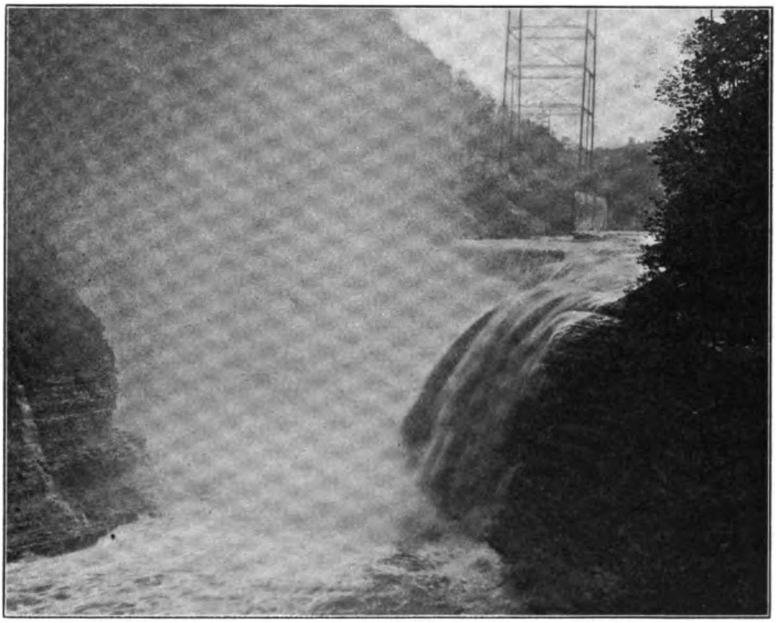


FIG. 34. Upper fall, seventy-one feet in height, veiled in its own mist.

let him pick his way carefully along the slippery and stony bank of the west side of the stream until he comes to a vantage point from which he may view the fall as seen in the above illustration. Along the west bank the road continues, and soon we hear the roar and see the mists of the middle fall, the greatest of the three. From an observatory on a small rocky plateau at the very brink of the fall, an impressive view may be had of the great volume of water as it drops over the precipice to the river about one hundred and seven feet below.

Leaving the little observatory, the path follows along the brink of the gorge to a point on the cliff not far from the residence of Mr. Letchworth, where we get a magnificent view of the gorge, looking northeast. The accompanying illustration gives some idea of this, but only a visit to the spot will make one realize its beauties. On either side are perpendicular walls of rock, beautifully variegated by alternating strata of shale and sandstone, rising to a height of three hundred and fifty feet, twenty feet higher than the palisades opposite New York City, crowned on the left bank with a mass of vegetation to an additional height of one hundred and fifty feet, making the total on that side nearly five hundred feet.

This gorge of the Genesee is often known as the Portage gorge, and these rocks, laid down nearly fifty million years ago, belong to the Portage epoch of the upper Devonian age. Most of what is now New York state then lay under a vast sea. The rivers of what land there was at that time washed their sediment down into this apparently shallow sea where it settled and formed not only the Portage rocks but also others of central and western New York. As time passed on, other and more modern strata were laid down on this Portage formation, burying it out of sight. Ages passed, and finally came a great upheaval of the continent, when the bottom of this sea was raised up and dry land was formed. As the center of this upheaval was to the north, the strata, which were formerly horizontal, assumed a gentle dip to the south. Then the elements attacked the land; the winds and the rains and the floods came and washed and eroded, until finally in millions of years the Portage rocks were again brought to view.

About the time of the glacial age a great depression occurred in the north, reversing the inclination of the land, making the rivers which formerly flowed to the south now take a northerly direction. But the glaciers, stopping up the valleys with their debris, formed large lakes, and one of these was located in the large basin-like area, a part of the old Genesee valley, to the south of the present Portage gorge. As the depression continued in the north, this lake began to overflow, naturally at the

By permission from a photograph made by Mr Edward Hagaman Hall.

GORGE OF THE GENESEE, AS SEEN FROM NEAR THE RESIDENCE OF MR. LETCHWORTH.

lowest point in its brim, which happened to be not at the region of the old valley, but at the site of the present gorge. This stream, probably at first but a small brook, following the line of least resistance, gradually wore for itself a tortuous channel, sinking it deeper and deeper as the years went by,[7] until it formed and is still forming for itself the deep channel known as

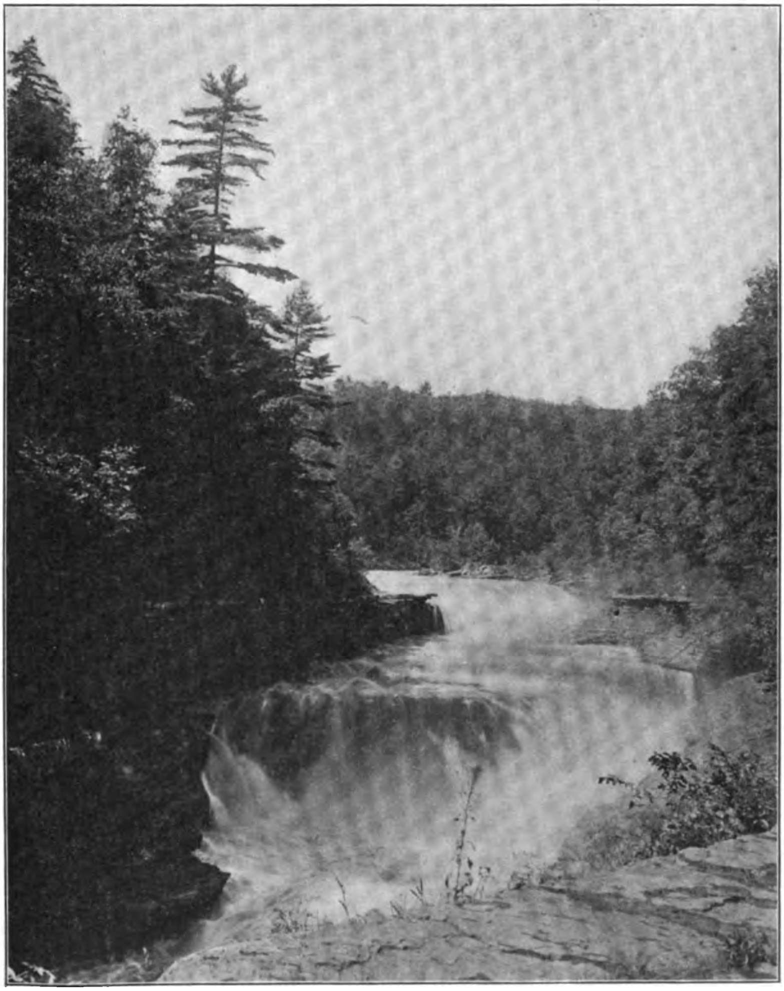


FIG. 35. Lower fall, looking up-stream from table rock, the separation into two cascades clearly shown.

the Portage gorge. At first there was probably but one fall, but, owing to the variation in the hardness of the strata, which wore away unevenly, the original fall began to split into two and then into three falls, and these are still changing their relative positions.

Leaving this interesting spot and continuing along the path which skirts the gorge, a walk of about one and a half miles brings us to the plateau above the lower fall. From this place a series of stairs and galleries descend to the bottom of the gorge, and bring us into a magnificent strip of old timber, consisting of large tulip-trees, hemlocks, maples, and other splendid trees. It is a delight to see this old timber, preserved from the devastating hand of the lumberman by obstacles thrown in the way by nature. On the one side is a tall cliff, now clothed with verdure, and on the other the raging waters of the river, two obstacles which the lumberman could not surmount, and so we have left to us a remnant and a reminder of what this whole region once was.

Passing through this strip of forest by a delightful woodland path, we suddenly emerge upon the brink of the chasm through which rush the waters of the lower fall. The view here presented of this fall is that which one sees from the upper end of Table Rock, displaying both cascades. Here is demonstrated the manner in which the three falls have separated, for you see the first step of the process, the breaking up of the lower fall into two cascades. In time these will separate more and more, and there will be four falls instead of three.

Two of the most interesting features of the lower fall region are Table Rock and Cathedral Rock, shown in the accompanying illustration. Many years ago Professor Hall said of Table Rock : " The table above, which was formerly the bed of the river, will in a few years become covered with soil and vegetation ; strong grass and willows will have taken root in the fissures, and these collecting about them a little earth, giving a soil for the support of other plants, the evidence of its original condition will be lost. A century hence, some incredulous observer may stand on the edge of Table Rock, then covered with shrubs and trees, and deny that the insignificant stream flowing in its bed can have excavated this deep chasm. An observer of similar disposition may now stand on the margin of the great gorge of the Genesee at Portage and say that it is impossible for this river to have worn it to the depth of 350 feet and a breadth of 600 feet. But the Genesee was once a more powerful stream, and it has flowed in its present direction longer than we are usually accustomed to consider as the age of the world." How true this prophecy was is evidenced by the trees and shrubs, and grass and other herbs now securing a firm foothold on this plateau.

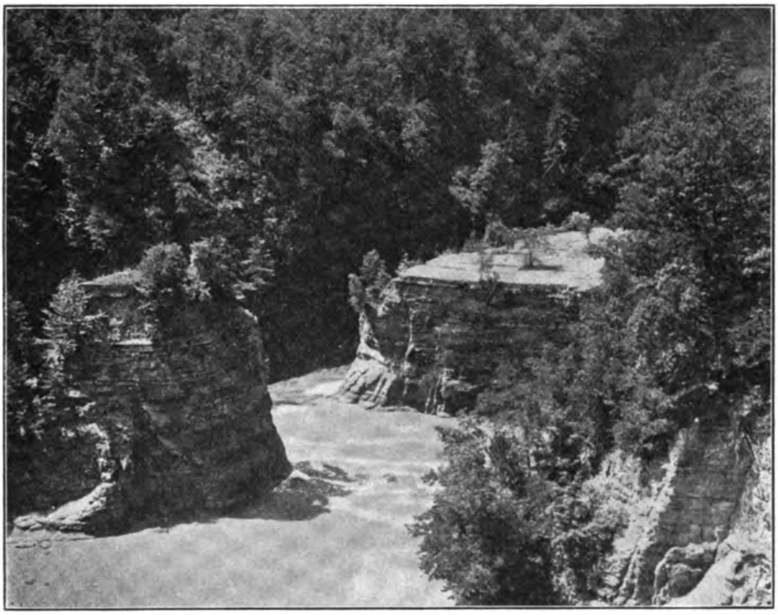


FIG. 36. **Table rock, with the flume to the left, and cathedral rock, as seen from the left bank.**

Leaving this beautiful region of the lower fall, we will return to the upper portions of the park, traversing this time, however, not the path along the brink of the gorge, but the road inland which passes through the farm lands, comprising several hundred acres of the estate. To the right of this road which parallels the Genesee, we see the Chestnut Lawn Farm, equipped as a modern dairy, while opposite to this, on the other side of the road, is the Prospect Home Farm, and beyond these the Lauterbrunnen Farm.

It is but a short step from this last farm to the residence of Mr. Letchworth. Here we find a commodious house with an ample porch on two sides, with large columns running up for two stories, so that many of the sleeping apartments look out upon it. To one side, between the residence and the front gate, is a little pond with a fountain playing continuously, fed by a perennial spring in the hillside near by. This fountain seems to be a vista-point, for it may be seen here and there from various parts of the grounds. Large evergreen and deciduous trees surround the house, among them a fine American elm and some magnificent specimens of the Norway spruce, perfect in shape and branched entirely to the ground, their long branches trailing in the grass. From the group of trees surrounding the house spread broad lawns, the planting so arranged as to form charming vistas, which terminate in many cases in the woodland beyond. The open stretches of lawn contain no flower beds, and the shrubbery does not obtrude and detract from the harmony around. Along the brink of the gorge trees have been planted, with openings here and there, so that beautiful vistas upon the falls and gorge meet the eye as one strolls along the paths. All trees and shrubs not native to the vicinity are confined to the regions in the immediate neighborhood of the residence, so that the woodlands beyond contain native plants only. It is a delight to walk through these woods and see the tulip-trees, white pines, Norway pines, cucumber-trees, elms, oaks, chestnuts, beeches, hornbeams, butternuts, and many other trees, natives of this region, in such great abundance.

One of the roads through these woodlands finally leads us to the Council House Grounds, one of the most interesting features of the park. Here will be found an old Indian council house, from which the reservation takes its name. This building, constructed of hewn logs, is about forty feet long and seventeen feet wide. Its exact age is uncertain, but it is known to antedate the revolution. It is a work of the Seneca Indians, and was formerly located at Caneadea, or Ga-o-ya-de-o, the uppermost of their villages on the Genesee, about eighteen miles from its present location. It was falling to decay when Mr. Letchworth decided to remove it to its present site in 1871. In taking it down each part was carefully numbered so that it might be put together exactly as it was originally.

The Senecas were one of the five nations which composed the league of the Iroquois, the other four being: the Mohawks, Oneidas, Onundagas, and Cayugas. Of these the Senecas were the most numerous, enterprising, and chivalrous, and were set to guard the western door of the confederacy. They were organized, devoted to agriculture, and were great orators. As Caneadea was in the southwestern border of the Seneca country, it was a convenient rendezvous of war-like parties passing to their fights in Ohio and Pennsylvania.

On October 1, 1872, the last council of the Senecas was held in this house, nineteen warriors, a mere remnant, being present from the neighboring reservation. At this council the Indians urged Mr. Letchworth to consent to adoption into the Seneca nation, which was their way of showing appreciation of his devotion to the interests of the Indians, for whom he had done so much. Mr. Letchworth, however, declined. That evening he was surprised by a visit from them, when they repeated their request, to which he acceded, the ceremony being performed on his front porch. As was their custom on such occasions, they bestowed on him a name — Hai-wa-ye-is-tah — meaning, "the man who always does the right thing."

Not far from the council house is the "White Woman's Cabin," and near by the grave of Mary Jemison. The house was built by Mary Jemison for one of her daughters on the Gardeau reservation. The monument in front of this house was erected by Mr. Letchworth to her memory. Upon this are two inscriptions which tell the story of her life among the Senecas.

At the further end of the Council House Grounds is a section of the big treaty oak which formerly stood on the banks of the Genesee below Mt. Morris, opposite Geneseo. This tree stood near where the treaty was made transferring practically all of the land west of the Genesee to the whites. It took place in 1797, in the presence of three thousand Indians, and consumed twenty-one days. Four million acres were disposed of for $100,000. This amount was placed in trust in the hands of the government, and the interest is still paid on it as an annuity to the Indians.

The Genesee Valley Museum contains many objects of interest relating to this section, among which are numerous Indian relics; also the head of a large mastodon, found about seven miles from Glen Iris in 1879, and purchased by Mr. Letchworth.

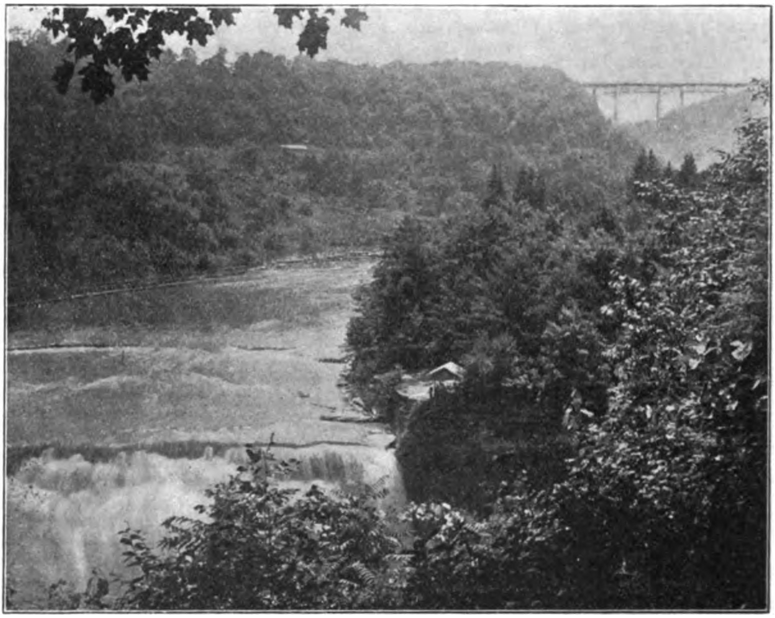


FIG. 37. Middle fall and the view up-stream, as seen from the lawn in front of the residence of Mr. Letchworth.

Before leaving Letchworth Park, let us descend the charming woodland path which connects this reservation with the home grounds and take a farewell look at the middle fall, which is shown in the last illustration. Here we are standing on the edge of the lawn, but a few feet from the south porch, looking up the gorge of the Genesee. Below, but a few hundred feet away, is the middle fall, sending up its clouds of mist and spray, which, on windy days, is blown upon the house near by, and in which, when the sun is shining, rainbows come and go. To the right is the little observatory, just on the brink of the fall, from which we have looked out upon the waters as they plunged below. Further on we see the hazy distance of the other shore, and still beyond the mist rising from the upper fall to the railway viaduct above. This is the view which Mr. Letchworth has looked upon for many years and of which he is very fond.

George V. Nash,
Head Gardener.

NOTES, NEWS AND COMMENT.

Dr. N. L. Britton spent November 18 and 19 in Washington and Baltimore examining collections of cacti, and in attending a meeting of the Committee on Policy of the American Association for the Advancement of Science.

Dr. W. A. Murrill visited Harvard University November 7 to examine types of certain Boletaceae in the Farlow collection.

The autumn course of lectures to the 4 B and 5 B pupils of the public schools of Bronx closed November 10. No postponements on account of rain were necessary during the entire course, and on only one occasion was the attendance materially reduced by threatening weather.

An interesting and unique celebration will be held on the estate of Mr. George W. Vanderbilt at Biltmore, North Carolina, during the Thanksgiving holidays, commemorating the twentieth anniversary of the beginning of practical forestry at Biltmore and the tenth anniversary of the Biltmore Forest School.

The regular autumn course of public lectures delivered in the large hall of the museum building on Saturday afternoons closed November 21 with Dr. H. H. Rusby's lecture on "The Rubber Plants of Mexico." These lectures have been well attended.

The first botanical convention of the present collegiate year was held in the library on the afternoon of Wednesday, November 4. Mrs. N. L. Britton gave an account of her recent collections in Jamaica; Mr. E. W. Humphreys described an interesting analogy existing between fossil plants and those now living; Mr. F. J. Seaver showed specimens of some fungi collected by him in North Dakota; and Mr. G. V. Nash exhibited a living specimen of *Stangeria*, a peculiar cycad obtained in Europe in 1902.

An interesting plant of the genus *Stangeria*, a native of southern Africa, may be seen among the cycads on the east side of house No. 1 of the public conservatories. Unlike all the other genera of the sago-palms, this one has pinnately veined leaflets, giving it much the appearance of some ferns. It was from this resemblance that Kunze, many years ago, named a leaf of this plant *Lomaria eriopus*. Living plants were brought into cultivation, which, on producing cones, disclosed the real nature of this plant. The name *Stangeria paradoxa* was then given to it, but the specific name must now give way to that used when it was described as a *Lomaria*. A young cone may be seen on the plant.

The total precipitation recorded at the Garden for October was 1.46 inches. Maximum temperatures were recorded of 75° on the 4th; 76.3° on the 11th; 88° on the 17th; 74.5° on the 19th, and 67° on the 26th; also minimum temperatures of 36° on the 3d; 39.5° on the 6th; 31° on the 13th; 37° on the 22d, and 34° on the 31st. Mean temperature for the month, 59.5°. First frosts occurred about the middle of the month.

ACCESSIONS.

LIBRARY ACCESSIONS FROM OCTOBER 1 TO OCTOBER 31, 1908.

BERGER, ALWIN. *Mesembrianthemen und Portulacaceen.* Stuttgart, 1908. (Given by Dr. N. L. Britton.)

BOULANGER, EMILE. *Notes sur la truffe.* Lons-le-Saunier, 1906. (Deposited by the Trustees of Columbia University.)

ENGLER, HEINRICH GUSTAV ADOLF. *Die Vegetationsformationen tropischer und subtropischer Länder.* Leipzig, 1908.

HENSLOW, GEORGE. *The heredity of acquired characters in plants.* London, 1908.

JONGKINDT CONINCK, A. M. C. *Dictionnaire Latin-Grec-Français-Anglais-Allemand-Hollandais, des principaul termes employés en botanique et en horticulture.* Bussum, 1907.

KRAEMER, HENRY. *A text-book of botany and pharmacognosy.* Ed. 3. Philadelphia, 1907. (Given by the Torrey Botanical Club.)

LERENARD, ALFRED. *Essai sur la valeur antitoxique de l'aliment complet et incomplet.* Paris, 1907. (Deposited by the Trustees of Columbia University.)

SAGRA, RAMON DE LA. *Histoire physique, politique et naturelle de l'ile de Cuba: botanique.* Paris, 1838–45. 2 vols. (By exchange with the Department of Agriculture, Jamaica.)

SENN, GUSTAV. *Die Gestalts- und Lageveränderung der Pflanzen-Chromatophoren.* Leipzig, 1908.

Zeitschrift für induktive Abstammungs- und Vererbungslehre. Band 1, Heft ½ Berlin, 1908.

MUSEUMS AND HERBARIUM.

113 specimens of mosses from Japan and Korea. (By exchange with Mr. J. Cardot.)

92 specimens "Uredineen," Fasc. 44 & 45. (Distributed by Professors H. & P. Sydow.)

3,000 herbarium specimens from Jamaica, W. I. (Collected by Dr. and Mrs. N. L. Britton.)

1 specimen of *Eruca sativa* from Pennsylvania. (Given by Messrs. J. M. Thorburn & Co.)

10 specimens of flowering plants from Galt, Ontario. (Given by Mr. W. Harriot.)

50 specimens "Musci Frond. Archipelagi Indici et Polynesiaci." (Distributed by Professor Max Fleischer.)

7 specimens of hepatics. (Given by Miss Annie Lorenz.)

54 specimens of mosses from the Himalaya Mountains. (By exchange with the Royal Gardens, Kew, England.)

32 specimens "Musci Norvegici." (By exchange with Dr. N. Bryhn.)

5 specimens "Hepaticae Canariensia." (By exchange with Dr. N. Bryhn.)

1 specimen of *Picea* from Keewatin. (Given by Mr. S. S. Cummins.)

7 specimens of flowering plants, co-types, from New Mexico. (Given by Professor E. O. Wooten.)

2 specimens of *Aragallus* from North Dakota. (Given by Professor H. F. Bergman.)

600 herbarium specimens from New York, Virginia, Tennessee and North Carolina. (Collected by Dr. P. A. Rydberg.)

4 specimens of *Phragmites aquehongensis*, tertiary (?) fossil plants. (Given by Dr. A. Hollick.)

8 specimens of fossil plants from the eastern United States. (Given by Dr. A. Hollick.)

190 specimens of cretaceous fossil plants from Long Island and Martha's Vineyard. (By exchange with the U. S. Geological Survey.)

PLANTS AND SEEDS.

2 cactus plants for conservatories. (By exchange with United States National Museum, through Dr. J. N. Rose.)

1 orchid for conservatories. (Given by Mr. J. C. Zeladon.)

3 plants o *Pandanus utilis* for conservatories. (Given by Mrs. John H. Hall.)

1 plant of *Livistona chinensis* for conservatories. (Given by Mr. W. H. Mehlich.)

1 plant of *Beaucarnea recurvata* for conservatories. (Given by Mr. J. Chr. G. Hupfel.)

4 erns for conservatories. (Given by Miss Margaret Slosson.)

14 cacti for conservatories. (By exchange with Mr. F. Weinberg.)

16 plants for the herbaceous collections. (Collected in the old nursery.)

60 plants for conservatories. (Collected in Jamaica by Dr. and Mrs. N. L. Britton.)

2 packets of *Crataegus* seed from Montana. (Given by Mr. B. T. Butler.)

33 packets of *Rubus* seed. (Collected by Dr. P. A. Rydberg.)

50 plants derived from seed from various sources.

EDIBLE MUSHROOMS.

JOURNAL

OF

The New York Botanical Garden

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EDIBLE MUSHROOMS IN BRONX PARK.

The popular interest in mushrooms of all kinds is almost phenomenal. This is due to their beauty of form and color and the supposed mystery surrounding their origin and growth, as well as to the use of certain kinds for food. Their nutritive value is not great, being about equal to that of cabbage, but they afford variety in flavor and add greatly to the relish for other foods.

Mushroom eating is much more in vogue in Europe than in this country. The struggle for existence is greater there, and the edible and poisonous varieties are better known by all classes of people. In China it is almost impossible for a botanist to get specimens, on account of the thorough manner in which all wild food is collected by the natives.

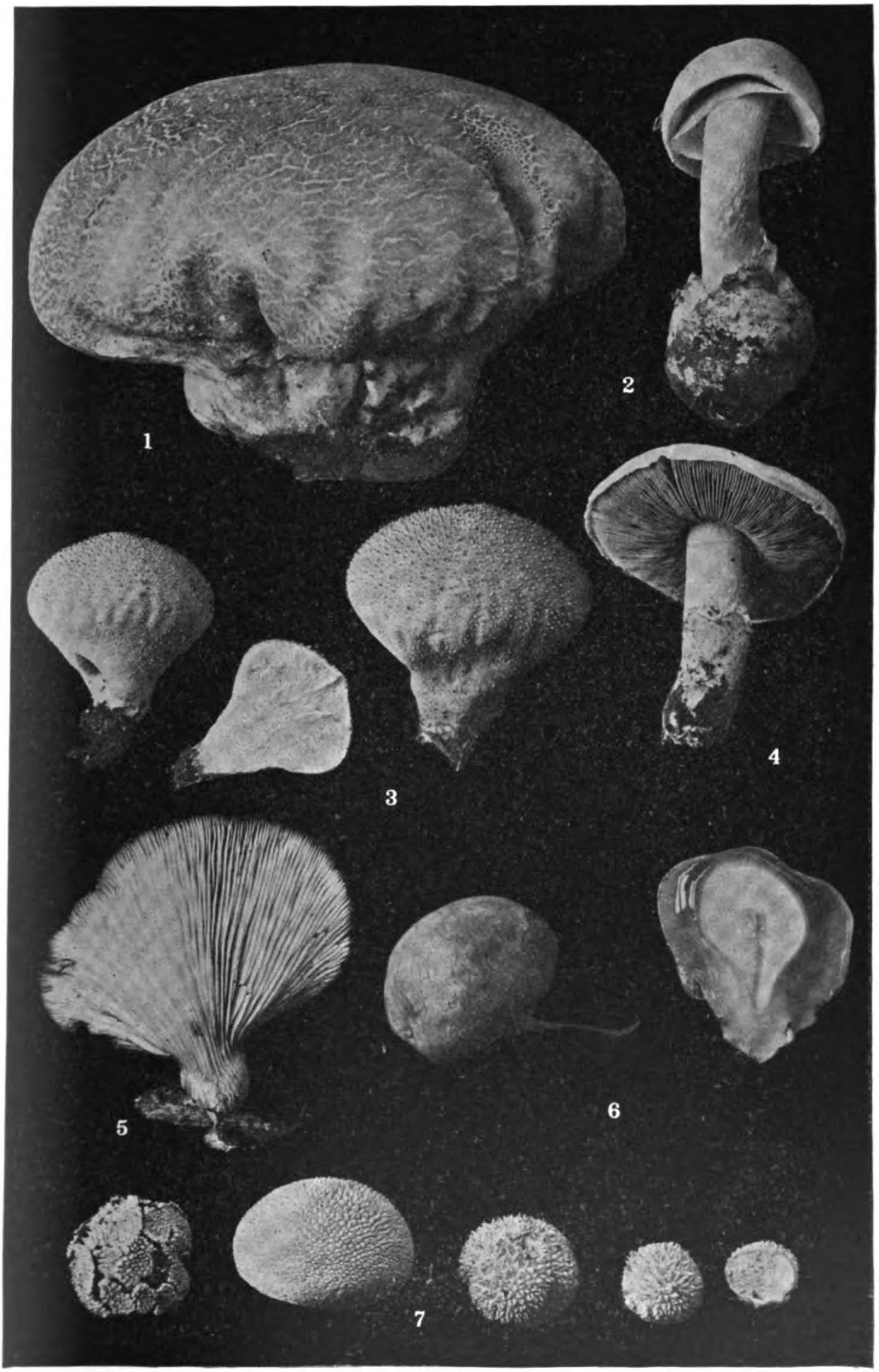
The use of mushrooms in this country is as yet very limited, being confined chiefly to our foreign-born population. Even in New York City many excellent kinds go to waste every season because they are different from kinds known in Europe. This is especially true of the puffballs, which do not seem to be generally recognized here as edible. On the other hand, many species are collected in a wholesale and indiscriminate manner by ignorant foreigners, who, while searching the lawns for the common mushroom and the stumps for the "beefsteak" mushroom and the honey agaric, appear to gather everything they find at all resembling edible forms known to them.

All knowledge regarding the edible and poisonous properties of mushrooms is based on experiments, either intentional or un-intentional. The only safe rule is to confine oneself to known edible forms until others are proven harmless. If one is a beginner, he is like an explorer in a new country with an abundance of attractive fruit near at hand, which may be good or may be rank poison; he cannot tell without trying it, unless some native, who has learned from his own and others' experience, shares his knowledge with him.

The writer on this subject undertakes a very responsible task, owing to the vast number of similar forms among the mushrooms which are distinguished with difficulty by those not accustomed to fine distinctions; but it should be possible to describe a few striking kinds in such a way that no serious mistakes will be made.

The common field mushroom (Pl. 55, fig. 4) is known to almost everyone who pretends to collect mushrooms at all, and the majority of collectors limit themselves entirely to this one kind. It grows in low grass on meadows or on rich, moist upland pastures, being common after rains from August to October. The upper side is white with brownish fibrils or scales, and the under side is a beautiful salmon-pink when young, changing gradually to almost black when old. The stem is colored like the top and has a loose white ring around it. There is little or no swelling at the base of the stem and no "cup," as in the deadly amanita, which latter, moreover, is white underneath and grows usually in woods or groves.

The "spawn," or vegetative portion of the common mushroom, is hidden in the soil and feeds upon the dead organic matter found therein. When the proper season arrives, small fruit bodies, known as "buttons," appear on the spawn and soon develop into "mushrooms," which are in reality only the mature fruit bodies of a delicate and widely branching plant entirely concealed in the earth. The parts of the fruit body are known as the "stem" and the "cap." On the under side of the cap are the "gills," which bear countless tiny bodies known as "spores," which are distributed by the wind and produce new plants as seeds do in the case of flowering plants. The cottony "ring" on the stem is what remains of a thin white "veil" which cov-



EDIBLE AND POISONOUS MUSHROOMS.

ered the gills in the younger stages of growth. This veil is not present in all kinds of mushrooms.

In the cultivation of the common mushroom, bricks of spawn are planted in suitable soil and the conditions of growth attended to with great care. Anyone wishing to grow mushrooms should provide himself with a good handbook on the subject, or learn the secret from a practical man in the business. It is not easy to do successfully unless done properly.

"Here's a destroying angel with its head broke off," shouted my small companion as we entered a beautiful oak grove in search of mushrooms. And, as we passed through, we found that several other "angels" had lost their heads, leaving the large "death-cups" almost hidden in the thin grass and leaf-mould where they grew. Evidently, this most poisonous of all mushrooms, the deadly amanita, had gone to grace somebody's feast,—and a single specimen of it is sufficient to kill four or five persons!

I have frequently noticed a tendency in young or inexperienced persons to belittle the dangers of mushroom eating, apparently believing that a show of bravado or fearlessness will overcome the effects of the poisonous kinds, as though they belonged to the category of myths or ghosts. It is, indeed, true that many varieties have been called poisonous when they were not, just as most of our snakes have been under the ban on account of the mischief done by three or four; but there are a few mushrooms that contain poisons just as deadly as that of the rattlesnake or copperhead, and these are responsible for practically all of the deaths due to mushroom eating. These poisons are narcotic, rather than irritant, and their effects are slow to appear.

If distress is experienced within four or five hours after eating mushrooms, it is a case of indigestion or minor poisoning and should readily yield to a prompt emetic. If, however, from eight to twelve hours have elapsed since eating the mushrooms, disagreeable symptoms should be taken very seriously, since it is almost certain that one of the deadly poisons is at work. A physician should at once be called and the heart action stimulated by a hypodermic injection of about one sixtieth of a grain of atropine, which should be repeated twice at half-hour intervals.

Atropine is an antidote to the poison of the "fly amanita," which paralyzes the nerves controlling the action of the heart. If the "deadly amanita," which dissolves the blood corpuscles, has been eaten, the atropine will probably do no good, and death will surely follow if the amount eaten is sufficient.

The "deadly amanita," shown in one of its forms in the accompanying illustration (Pl. 55, fig. 2), is a very conspicuous and beautiful object, occurring throughout the summer and autumn in open groves and along the edges of woods. Neither its odor nor its taste is disagreeable, as is the case with most inedible mushrooms, and it must be recognized by a careful study of its form and parts, which are, fortunately, very characteristic.

The most important part of the deadly amanita is the sheath at the base of the stem known as the "death-cup," which is well shown in the illustration. This is what remains of the outer coat of the "egg" after the cap has burst from it and has been carried upward by the growing stem. The ring on the stem is similar to that of the common mushroom, but the gills are white, both when young and old, those of the common mushroom being at first pink, then black. Nothing can be told from the color of the upper surface of the cap because it varies so much, being pure white, yellowish, brownish or blackish. Sometimes the surface is perfectly smooth and at other times it is adorned with pieces of the "death-cup," which were carried up on it when the cap burst through the roof of the "egg."

When gathering mushrooms it is exceedingly important to get all of the stem and not leave a portion of it in the ground, since the "death-cup" may thus be overlooked. Mushrooms should not be gathered in the "button" stage unless mature specimens are growing in the same place, otherwise an "egg" of one of the poisonous kinds may be collected by mistake.

The "fly amanita" is as beautiful as it is dangerous. The cap is usually bright scarlet, yellowish or orange, sometimes fading to nearly white, and covered with conspicuous warts, which are portions of the death-cup carried up from below. The rest of the cup will usually be found in fragments in the soil about the swollen base of the stem. The gills are white and remain so, thus differing from those of the common mushroom. The warts on the cap also distinguish it. I have not found this species common here, but it is very abundant in many localities, both in this country and in Europe.

The death-cup and its remains on the surface of the cap should always be looked for, and no mushroom of this group should be eaten by the beginner, although some of them are most excellent.

The parasol mushroom is too much like the amanita to be recommended for general use, but careful observers may soon learn to know it accurately. The cap is fawn-colored or brownish, and its surface is broken up into broad, thick scales, which, being a part of the cap, do not separate readily. In the amanita the "scales" are parts of the roof of the death-cup and may be easily removed from the cap. The parasol mushroom also differs from amanita in having a free and movable, instead of a fixed, ring, and in having no cup nor fragments of a cup at the base of the stem, although the base is swollen. This excellent variety grows in thin woods or along the edges of fields. It is one of the best to dry for winter use.

The oyster mushroom, found in dense clusters on decayed logs in woods, can hardly be mistaken for any poisonous kind. It is attached to the log by its side or by a very short stem, and is white throughout, with a slight grayish or brownish tinge. A very nearly related edible species, the sapid pleurotus (Pl. 55, fig. 5), which cannot be distinguished from the oyster mushroom by the amateur, grows especially on elm logs in this vicinity.

The "ink-caps" are abundant and excellent, and it is almost impossible to confuse them with poisonous species on account of the peculiar way they have of melting into a black fluid when mature. The glistening ink-cap grows abundantly about stumps and dead trunks, especially of elm, and appears very early in the season. It grew last year on buried wood under a tree in my yard, the small, light buff caps appearing by the hundreds in dense clusters after rains from April to November. When seen in the early morning, when the plants were crisp and fresh, they glistened as though dusted with powdered mica. Later in the day, the caps expanded and turned black on the under side and finally went to pieces. They should be gathered young and cooked within a few hours after picking.

The common ink-cap grows in close clusters on lawns, appearing about the same time with the field mushroom. It is much larger than the glistening ink-cap and is gray or smoky above with a few scales on the very top of the cap, and white below, but soon becomes black and melts away.

The "shaggy-mane" is a very striking object when it appears on lawns, being cylindrical in shape, with shaggy, white upper surface and white or pinkish gills, which melt into an inky fluid at maturity. This is the largest and best, but also the rarest, of the ink-caps.

The many-headed clitocybe (Pl. 54, fig. 4) occurs in dense clusters on lawns, especially in rather long grass, and is usually found in great abundance when found at all. Its flesh is very firm, with a slight oily flavor, and it may be kept for several days without deteriorating. It is a valuable species and worth transplanting.

The rough-stemmed boletus (Pl. 54, fig. 5) is a very handsome edible species and the most abundant of the group of fleshy fungi having tubes instead of gills on the under side of the cap. The majority of these are edible, but they are rather difficult to distinguish, and a few species are considered dangerous. The Germans collect many of these edible forms under the name of "steinpilz."

The equestrian tricholoma (Pl. 54, fig. 3), occurring in sandy soil under or near evergreen trees, is too rare in this region to be of importance. The specimens figured were collected in New Jersey.

The honey-colored armillaria, or honey agaric (Pl. 54, fig. 2), occurs in great profusion in the autumn in this locality on and about old stumps and attached to buried roots of both deciduous and evergreen trees, on which it grows as a parasite. It is well known to the Italians, being common also in Europe, and is eagerly collected by them here. I recently saw one in the hemlock grove with over a bushel of the sporophores of this fungus.

The "brick-top," or perplexing hypholoma (Pl. 54, fig. 1), likewise occurs abundantly in this vicinity until very late in the season, but is confined to the stumps and roots of deciduous trees, appearing in conspicuous reddish clusters of considerable size. Its flavor is not particularly good, but it is useful because of its very late appearance, and it improves puffballs and other species with little flavor when mixed with them.

Puffballs are the safest of all mushrooms for the beginner, none of them being poisonous; and they are at the same time very excellent and very easy to get.

The field puffball (Pl. 55, fig. 1) is found on the lawns and in fields where the common mushroom grows. Very few persons seem to know its excellence. It is often picked when young because of a faint resemblance to the common mushroom in color, and at once thrown away. The accompanying illustration was made from a specimen collected in the fruticetum of the Garden, measuring six inches in diameter, but it is often not larger than a good-sized pear, which it somewhat resembles in shape. The surface is gray and nearly smooth, and the inside milk-white, becoming purple when old and dry. The name puffball is assigned because of the cloud of dust which arises from one of these old dried specimens when stepped upon.

A much smaller kind, about the size of a large marble, is abundant in the same localities where the field puffball occurs (Pl. 55, fig. 7). It is pure white and so abundantly adorned with spines that it appears shaggy. When older, these spines peel away and show the thin, brown inner coat, thus suggesting the name "separating" puffball.

The studded puffball (Pl. 55, fig. 3), found on the ground in woods, is smaller than the field puffball, but is abundant and has a longer season. It is pure white, pear-shaped, and ornamented with spines having bases resembling cut gems. Another kind, slightly darker and smaller but of similar shape, called the pear-shaped puffball, occurs in dense clusters on rotten logs and stumps in woods. I have found this abundant here late in November. The giant puffball, which is rarely smaller than a man's head and sometimes attains the huge size of ten feet in circumference, also occurs in woods, usually near old stumps or in rich leaf-mould. There is a shallow pit in the hemlock grove in the Botanical Garden where it appears every year; and at Ithaca, New York, there used to be a stretch of low beech woods with a number of old stumps, where one might be sure of finding it when the weather was seasonable. At a distance these giant puffballs looked like a group of smooth white boulders, and a small section of one of them was sufficient for a meal.

Puffballs are good either stewed, or fried in thin slices with butter, but cooked in the latter way they soak up a quantity of butter and are very rich. Being tender they cook quickly and are easily digested. They should as a rule be cut open before cooking to see that they are not too old and that they are really puffballs. If they are white and firm like cream cheese inside, showing no yellow or brownish discoloration, they are of the right age to use. If the interior shows no special structures, but is smooth and of the same color and appearance all the way through, then one may be sure he has a puffball. The "egg" of the amanita contains the young cap and stem inside, which is readily seen when the egg is cut; and the egg of the poisonous stinkhorn (Pl. 55, fig. 6) shows the stem and a green mass inside surrounded by a layer of jelly-like substance.

The hard-skinned puffball, although edible when young, is an exception to the color rule, being almost perfectly black inside. It also differs from most puffballs in having a hard yellowish-brown, warty rind, which must, of course, be peeled off if an attempt is made to use this kind for food. It is commonly found in rather firm soil in dry woods.

The coral mushrooms are easily known by their striking resemblance to clusters of delicately branched coral. They grow on the ground or on rotten wood in dense shade, and are whitish or yellowish in color. Unfortunately, I have not found them abundant about New York. When tender and of mild flavor they make a delicious dish. None of them are poisonous. A near relative of the true coral mushrooms, called Sparassis, was found recently at New Rochelle by Miss Daisy Levy and brought to me for determination. This is a very excellent edible species and cannot be confused with poisonous kinds.

There is still one excellent kind that I must not fail to mention. The "beefsteak" mushroom, common on chestnut and oak stumps, may be readily recognized by its resemblance to a piece of beefsteak. The cap is red and juicy, and is attached by a short lateral stem. When cut open, the inside appears reddish and streaked or mottled like the cut surface of a beet root. The flesh is very firm and keeps for several days. If the acid taste is objectionable, it may be easily corrected by the use of soda while cooking. This mushroom will probably be very abundant about New York in the next few years because of the great number of dead chestnut trees.

In conclusion, my advice to beginners is to confine themselves at first to the common mushroom, the beefsteak mushroom, the puffballs, the coral mushrooms and other readily recognizable forms, being careful to carry with them when collecting an accurate mental picture of the deadly kinds, which have the death-cup or the peculiar patches on the cap, and to avoid mushrooms that are either too young or too old when selecting specimens for the table. If one *must* experiment, let him begin with experiments in cooking, since the way in which a mushroom is cooked often has much to do with its flavor and digestibility.

The photographic work for the accompanying illustrations was done by Mr. F. C. Berte and the color work by Mr. E. C. Volkert.

W. A. Murrill,
Assistant Director.

Explanation of Plates LIV and LV.

Plate LIV.

Fig. 1. "Brick-top" or perplexing hypholoma.
Fig. 2. Honey-colored armillaria or honey agaric.
Fig. 3. Equestrian tricholoma.
Fig. 4. Many-headed clitocybe.
Fig. 5. Rough-stemmed boletus.

Plate LV.

Fig. 1. Field puff-ball.
Fig. 2. "Deadly amanita."
Fig. 3. Studded puff-ball.
Fig. 4. Common field mushroom.
Fig. 5. Sapid pleurotus.
Fig. 6. Poisonous stinkhorn.
Fig. 7. "Separating" puff-ball.

THE MUSEUM COLLECTION OF FOSSIL PLANTS.

THE ORIGINAL COLLECTION. — The nucleus of the museum collection of fossil plants is the material deposited by Columbia University with the Garden under an agreement dated May 3, 1901, in which year it was transferred from the University to the museum building. It consists almost entirely of collections gathered together during a period of some forty years by the late Dr. John Strong Newberry, formerly professor of geology and paleontology at Columbia.

The number of specimens in the collection at the time when the transfer was effected was roughly estimated at about 8,oco. Subsequent work, however, in the arrangement of the museum, clearly indicated that this estimate was too low. It also did not include a large number of specimens contained in several boxes which had apparently never been opened. These have recently been unpacked and the specimens arranged with the others in their proper sequence — a piece of work which was impossible of accomplishment until this year, when the six new cases provided for the purpose became available. A somewhat hasty enumeration now indicates that at least 2,000 specimens from this source should be added to the original estimate and that the Columbia University collection may be conservatively credited with not less than 10,000 specimens.

The scientific value of this collection in its entirety, and the historical interest which attaches to a large part of it, cannot be adequately described or discussed within the limited scope of this article; but brief references to the more important facts in connection with certain of the material may serve to at least indicate what the collection as a whole represents.

Among the most interesting specimens, from the historical standpoint, are those collected by Dr. Newberry about 1850, upon which he based his earliest paleobotanical contribution, "Fossil Plants from the Ohio Coal Basin." This paper was read before the Cleveland Academy of Natural Science in 1853, and may be found in the Proceedings, pp. 26–53. This same paper, with additions, was also published as a series of articles, sparsely illustrated, in the Annals of Science, 1: 95–97; 106–108; 116, 117; 128, 129; 152, 153; 164, 165; 268–270; 280–281. 1853, and 2: 2, 3. 1854. These papers are among the earliest contributions to American paleobotany and the specimens described in them are among the earliest described American fossil plants. Unfortunately, however, many of these are impossible of identification with the descriptions and figures, although for the most part they are designated as to name and locality by printed labels, evidently text cut from the articles in the Annals of Science. The specimens collected by Dr. Newberry may therefore be definitely identified, but it is merely an assumption that those designated by the text labels are the exact ones upon which the names and descriptions were based, except in the case of those which can be identified by means of the figures.

Other important collections, made by Dr. Newberry personally, or made by others and reported upon by him, are such as were obtained during the prosecution of various government explorations, from about 1855–60, viz., the Northwest Boundary Commission, the Pacific Railroad and the Macomb, Ives, and Raynolds expeditions, in what was at that time generally known as "the far West." Just how complete these collections may be can probably never be determined, but they contain a large number of the type specimens described in certain of the published reports of these expeditions and for that reason alone their scientific value can hardly be overestimated.

Subsequently Dr. Newberry was Director of the Ohio Geological Survey and also assisted in the preparation of several paleontological reports for other geological surveys, and further collections of fossil plants were obtained from these sources, the most extensive of which is that from the Cretaceous of New Jersey, upon which he based his "Flora of the Amboy Clays," published in 1896 as Monographs of the United States Geological Survey, Volume XXVI. This latter collection is practically intact and includes not only all of the type and figured specimens described in the Monograph but also a large number of duplicates which serve as valuable material for exchange.

Among the smaller collections may be specially noted those upon which Dr. Newberry based the following contributions:

"Descriptions of Fossil Plants from the Chinese Coal-bearing Rocks, etc." Smithsonian Cont. **15**: 119–123, *pl. 9.* 1867.

"Descriptions of Some Peculiar Screw-like Fossils from the Chemung Rocks." Ann. N. Y. Acad. Sci. **3**: 217–220, *pl. 18.* 1885.

"Fossil Fishes and Fossil Plants of the Triassic Rocks of New Jersey and the Connecticut Valley." Monog. U. S. Geol. Surv. **14**. Washington, 1888.

"Rhaetic Plants from Honduras." Amer. Jour. Sci. **36**: 342–351, *pl. 8.* 1888.

"Devonian Plants from Ohio." Jour. Cincinnati Soc. Nat. Hist. **12**: 48–57, 104, 105, *pls. 4–6.* 1889.

"The Flora of the Great Falls Coal Field, Montana." Amer. Jour. Sci. **41**: 191–201, *pl. 14.* 1891.

A few specimens only are lacking in the above-mentioned collections, and these may possibly be found among the unassorted specimens when these are subjected to final careful scrutiny.

Among the miscellaneous material may be specially noted the extensive collection made in Australia in 1838–42, by the Wilkes Exploring Expedition, containing the type specimens described by Dana in volume 10, Appendix to the Report on the Expedition; two collections of Upper Devonian plants from the celebrated "Fern Ledges" of New Brunswick, made and identified by C. F. Hartt; a suite of specimens from the Tertiary sandstone of Bridgeton, N. J., mostly collected by the late Dr. John I. Northrop, which have been made the subject of a forthcoming Bulletin of the U. S. Geological Survey, by the writer, and numerous lesser collections upon which more or less well-known contributions have been based. Among these latter may be noted the following:

"The Potomac or Younger Mesozoic Flora." Wm. M. Fontaine. Monog. U. S. Geol. Surv. **15**. Washington, 1889. (A small number only of the specimens described.)

"Note on a Collection of Tertiary Fossil Plants from Potosi, Bolivia." N. L. Britton. Trans. Amer. Inst. Min. Eng. **21**: 250–259, *illust.* 1893. (Collection complete.)

"Preliminary Contribution to Our Knowledge of the Cretaceous Formation on Long Island and Eastward." Arthur Hollick. Trans. N. Y. Acad. Sci. **12**: *222–237*, *pls. 5–7.* 1893. (Collection complete.)

"Additions to the Paleobotany of the Cretaceous Formation on Long Island." Arthur Hollick. Bull. Torrey Bot. Club **21**: 49–65, *pls. 174–180.* 1894. (Collection complete.)

"The Cretaceous Clay Marl Exposure at Cliffwood, N. J." Arthur Hollick. Trans. N. Y. Acad. Sci. **16**: 124–136, *pls. 11–14.* 1897. (Collection complete.)

"Notes on Block Island." Arthur Hollick. Ann. N. Y. Acad. Sci. **11**: 55–88, *pls. 2–9.* 1898. (Collection complete.)

"A Report on a Collection of Fossil Plants from Northwestern Louisiana." Arthur Hollick. Geol. Surv. La., Rept. **1899**: *276–288*, *pls. 32–48.* 1900. (Collection complete.)

ACCESSIONS BY THE GARDEN. — Accessions have been received from a variety of sources since the original collection was installed, either by the purchase of specially desirable material; by exchange; by donation; or by collections made during the prosecution of field work under the auspices of the garden; and it seems pertinent to here call attention to the fact that these accessions were mostly all obtained from time to time, either for some special purpose in connection with the museum, or through some important investigation or report, and not merely with the object of increasing the size of the museum collection.

By Purchase. — The largest single accession is the collection of Cretaceous plants from the Dakota sandstones of Kansas, purchased from Mr. Charles H. Sternberg. This contains some 1,400 specimens, beautifully preserved and admirably adapted for display purposes. It also includes some of great biological interest, such as an almost perfect petal of a large magnolia flower and two well-preserved fig fruits. Both of these are unique fossils, not elsewhere represented in any museum, so far as known. They may be found described and figured in a paper entitled "A Fossil Petal and a Fossil Fruit from the Cretaceous (Dakota Group) of Kansas" in the Bulletin of the Torrey Botanical Club, **30**: 102–105, *figs. A. B.* 1903.

By Exchange. — Three collections have been added by exchange of specimens. One of European Jurassic and Tertiary plants, from the Natural History Museum of Paris, containing 75 specimens; the others of Tertiary plants from the John Day Valley beds of Oregon, and Cretaceous and Tertiary plants from the Yellowstone National Park, from the U. S. National Museum, consisting of 15 and 50 specimens, respectively.

In exchange for reports on collections submitted for examination to the curator of fossil botany the following accessions are to be noted:

About 500 specimens representing the flora of certain Cretaceous, Tertiary and Quaternary horizons in Maryland, from the Maryland Geological Survey. Two reports on this material have been issued, viz.: "Plantae: Phanerogamia." Md. Geol. Surv., Miocene: 483–486, *figs. 1a–1h.* 1904, and "Systematic Paleontology of the Pleistocene Deposits of Maryland: Pteridophyta and Spermatophyta." *Ibid.* Pliocene and Pleistocene: 217–237, *pls. 67–75.* 1906. All of the type specimens described and figured in these reports are included.

About 200 specimens representing the Cretaceous flora of Long Island and Marthas Vineyard, from the U. S. Geological Survey. These are duplicates, a number of them counterparts of type specimens, forming a part of the material upon which was based "The Cretaceous Flora of Southern New York and New England," issued as Monographs of the United States Geological Survey, Volume L., Washington, 1906. In this instance the Garden could only secure the duplicates, as all type or figured specimens collected through the Survey are by law required to be deposited in the U. S. National Museum.

About 160 specimens of Tertiary plants from Louisiana, not yet reported on, from the Louisiana Geological Survey.

About 25 specimens from the Grand Gulf formation of Alabama, from the Geological Survey of Alabama. Examined and reported upon.

About 20 specimens from the Laramie formation of the Bad Lands, from the American Museum of Natural History. Examined and reported upon.

By Donation. — The following collections have been added through donations:

About 350 specimens from the Cretaceous clay marls of New Jersey, by Mr. E. W. Berry, containing all of the type and figured specimens described in the following contributions:

"The Flora of the Matawan Formation (Crosswick's clays)." Bull. N. Y. Bot. Gard. **3**: 45–103, *pls. 43–57.* 1903.

"New Species of Plants from the Matawan Formation." Amer. Nat. **37**: 677–684, *figs. 1–9.* 1903.

"Additions to the Flora of the Matawan Formation." Bull. Torrey Bot. Club **31**: 67–82, *pls. 1–5.* 1904.

"Additions to the Fossil Flora from Cliffwood, New Jersey." Bull Torrey Bot. Club **32**: 43–48, *pls. 1, 2.* 1905.

About 75 specimens from the Tertiary shales of Florissant, Colorado, by Professor T. D. A. Cockerell. These include several unique and interesting examples of the preservation of delicate plant remains, two of which have been made the subjects of special papers, viz.:

"American Fossil Mosses, with Description of a New Species from Florissant, Colorado." E. G. Britton and Arthur Hollick. Bull. Torrey Bot. Club **34**: 139–142, *pl. 9.* 1907.

"Description of a New Tertiary Fossil Flower from Florissant, Colorado." Arthur Hollick. Torreya **7**: 182–184, *figs. 1, 2.* 1907.

About 50 specimens from the Lower Cretaceous (Great Falls Group) of Montana, by R. S. Williams, including the type of *Zamites Montanensis* Font. (See article in the JOURNAL, **7**: 115. 1906.)

In addition to the above collections there have been several lesser ones donated, probably aggregating about 100 specimens in all.

By Collection. — Through the members of the staff and others interested in the Garden, specimens are constantly being added from collections made in the field. Three of these may be specially mentioned, viz:

About 150 specimens from Long Island and Martha's Vineyard, forming part of the material previously mentioned as the basis of the U. S. Geological Survey Memoir on " The Cretaceous Flora of Southern New York and New England." A number of the type specimens there decribed and figured are included.

About 50 specimens of fossil leaf impressions, lignites and amber from the Cretaceous clays of Kreischerville, Staten Island, containing the best preserved Cretaceous material for structural study ever discovered. Several preliminary papers dealing with these remains have been issued viz.:

"The Occurrence and Origin of Amber in the Eastern United States." Arthur Hollick. Amer. Nat. **39**: 137–145, *pls. 1–3.* 1905.

"Affinities of Certain Cretaceous Plant Remains Commonly Referred to the Genera *Dammara* and *Brachyphyllum.*" Arthur Hollick and E. C. Jeffrey. Amer. Nat. **40**: 189–216, *pls. 1–5.* 1906.

" On Cretaceous Pityoxyla." E. C. Jeffrey and M. A. Chrysler. Bot. Gaz. **42**: 1–15, *pls. 1, 2.* 1906.

"The Wound Reactions of Brachyphyllum." E. C. Jeffrey. Ann. Bot. **20**: 383–394, *pls. 27, 28.* 1906.

" Araucariopitys, a New Genus of Araucarians." E. C. Jeffrey. Bot. Gaz. **44**: 435–444, *pls. 28–30.* 1907.

" On the Structure of the Leaf in Cretaceous Pines." E. C. Jeffrey. Ann. Bot. **22**: 207–220, *pls. 13, 14.* 1908.

Part of this material has also been utilized in the preparation of a forthcoming Memoir of the Garden, now ready for the press, and the remainder for a subsequent contribution which is planned to be issued as a publication of the U. S. Geological Survey, from which source a grant of $300 was obtained for the prosecution of field and laboratory work.

About 15 specimens of Devonian (Cattskill Group) plants, from Tannersville, Pennsylvania, an horizon which has yielded comparatively few well-defined fossil plants in this region.

Summary of Accessions. — It may thus be seen that the Garden has added to the original collection:

By purchase,	1,400	specimens.
" exchange,	1,045	"
" donation,	575	"
" collection,	215	"
Total,	3,235	

It should also be remarked that the number indicating the number of specimens collected (215) is more or less misleading for the reason that a large part of these consist of finely divided lignitic material, contained in vials or massed in bulk, each so-called specimen, therefore, including many individual specimens.

ARRANGEMENT OF THE COLLECTION. — The general arrangement of the collection is on the basis of geologic sequence, and is designed primarily to indicate the evolution of plant life from its earliest appearance on earth up to the present time. The best preserved specimens, or those which have some special significance or are of value for general educational purposes, are displayed under glass, and the remainder are arranged in the tiers of drawers beneath the floor cases.

There are now twelve floor cases and five wall cases, located in the main basement hall, to the east and west of the central part, and numbered in accordance with the geologic sequence of time and periods, as follows: (See Fig. 38.)

FLOOR CASES.

No. 1 — Paleozoic Time. Cambrian, Ordovician, Silurian, Devonian and early Carboniferous Periods.
Nos. 2–4 — Paleozoic Time. Carboniferous Period.
No. 5 — Mesozoic Time. Triassic and Jurassic Periods.
Nos. 6–8 — Mesozoic Time. Lower Cretaceous Period.
No. 9 — Mesozoic Time. Upper Cretaceous Period.
No. 10 — Neozoic Time. Tertiary Period (Eocene).
No. 11 — Neozoic Time. Tertiary Period (Eocene and Miocene).
No. 12 — Neozoic Time. Tertiary (Miocene), Quaternary and Modern Periods.

WALL CASES.

No. 1 — Paleozoic Time. Cambrian, Ordovician, Silurian and Devonian Periods.
Nos. 2–4 — Paleozoic Time. Carboniferous Period.
No. 5 — Neozoic Time. Tertiary and Quaternary Periods.

A fair idea of the sequence of plant life in the history of the earth may therefore be obtained by observing the specimens in their sequence in accordance with the numbering of the cases, as indicated in Fig. 38. This, as previously stated, is a geological arrangement, but incidentally it is also roughly biological and follows the same system as that on which the museum of systematic botany is arranged, inasmuch as the plants of the earlier periods are low in the scale of life and those of the later

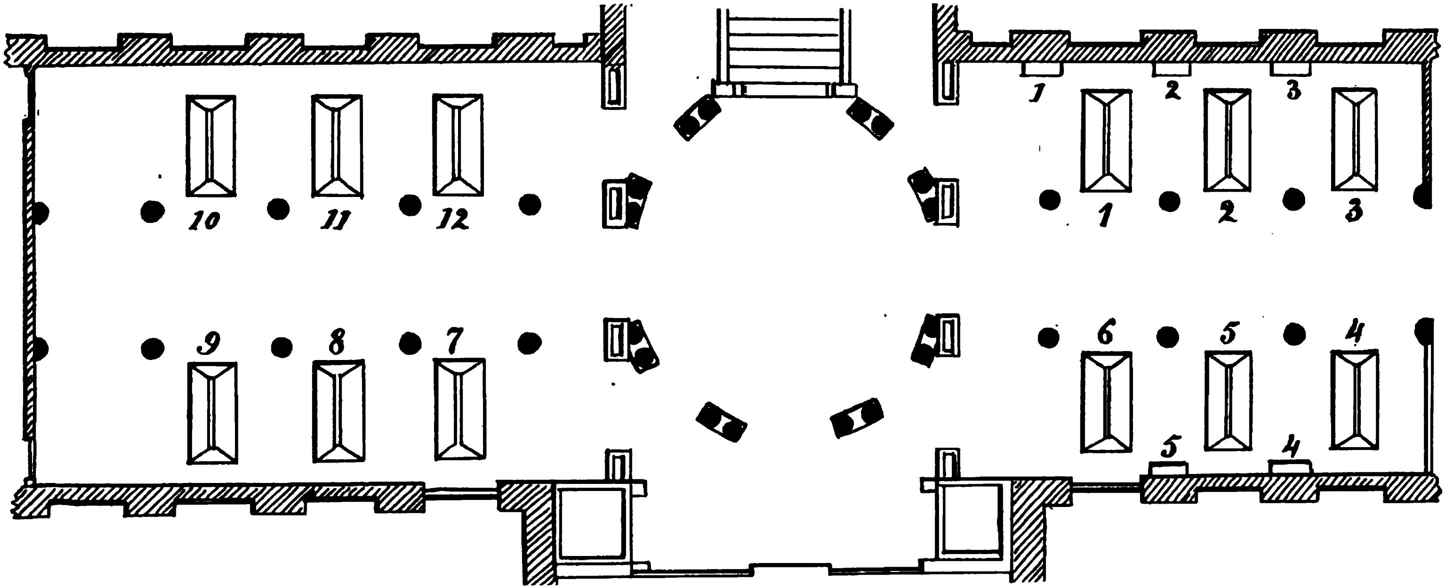


FIG. 38. Diagram of east and west wings of main basement floor, showing arrangement of the cases containing the paleobotanical collection.

periods include a constantly increasing number of the higher forms. Thus, for example, in the cases representing Paleozoic time the plants are all thallophytes or seaweeds, pteridophytes or ferns and their allies, cycado-filices or cycad-ferns, and a few conifers. In the first case representing Mesozic time, containing the plants of the Triassic and Jurassic periods, the majority consists of gymnosperms, both cycads and conifers, while in the next succeeding Mesozoic cases, containing the Lower and Upper Cretaceous plants, nearly all are angiosperms, many of them included in genera now in existence. The cases representing Neozoic time contain a constantly increasing number of living genera of angiosperms, until finally, in the last case, may be seen the remains of Quaternary plants which are indentical, both generically and specifically, with our living flora.

Coincident with this general arrangement, which illustrates the evolution of the vegetable kingdom as a whole, each case contains some individual specimens, or groups of specimens, which illustrate certain features or indicate certain phases of the subject, which are of interest to students in special lines of investigation. For example, most of the problematic fossils, those which have been classed by some authorities as the remains of plants and by others as traces of animals or as inorganic markings, may be seen in floor and wall cases No. 1; namely, *Plumulina*, which is probably a hydroid; *Phytopsis*, which may be a coral; *Scolithus*, almost certainly caused by worm burrows; *Dendrophycus*, which may represent current markings; *Dictyolites*, which is most likely due to sun cracks, etc. These, and others under the genera *Paleophycus*, *Fucoides*, *Arthophycus*, *Archaeophyton*, etc., have all been and some still are subjects of controversy as to their origin or relationships. In floor case No. 2 and floor and wall cases No. 3, are most of the fern-like plants, all of which were formerly thought to be true ferns, but many of which are now known, from critical study of the remains, to belong to an extinct order, Cycadofilicales, which had the outward appearance of ferns with fructification similar to that of the cycads or sago palms. Representatives of the interesting "*Glossopteris* flora" may be found in floor case No. 5, — a flora of uncertain botanical relationship which flourished in the transition period between Paleozoic and Mesozoic Time, particularly in the southern hemisphere, and may yet have its living prototype in the South African genus *Stangeria*, a cycad having leaves with pinnately arranged forking veins, similar to ferns. Fossil plants found within the limits of the City of New York, on Staten Island, or in the immediate vicinity, in New Jersey and on Long Island, are displayed in floor cases Nos. 6 and 7. Methods of preservation, either by petrification, incrustation or carbonization, are shown by numerous specimens of silicified wood, remains of various kinds from the vicinity of calcareous or silicious springs, and from Quaternary and recent swamp deposits, in wall case No. 5, and in floor cases Nos. 11 and 12. A large part of the material in floor case No. 12 is designed especially to indicate how our living flora is being preserved in our peat bogs and other swamp and pond deposits and gradually converted into lignite, by the slow process of natural distillation.

A view of the north side of the east wing of the museum hall, containing floor and wall cases Nos. 1–3, is shown in Fig. 39.

Facilities for Critical Study and Research. — While the main object of the museum arrangement is to enable the casual visitor to obtain a general idea of the significance of the collection and the salient features which it represents, it is also well adapted for critical study and research. The plants of any given horizon or period may be found in their proper stratigraphic position in the cases, in accordance with the general arrangement of the museum, and the specimens from each locality, or those collected by any expedition at any one time from an extensive area or region are grouped together, and whenever possible a duplicate copy of the paper in which the specimens are described is deposited with them for ready reference. Type specimens are designated by red stars and others which have been the subjects of illustrations are indicated by blue triangles.

The library of fossil botany, which has been developed in connection with the collection, is now second only to that of the U. S. National Museum. Cordial relations have been established with practically every paleobotanist in the world, with the result

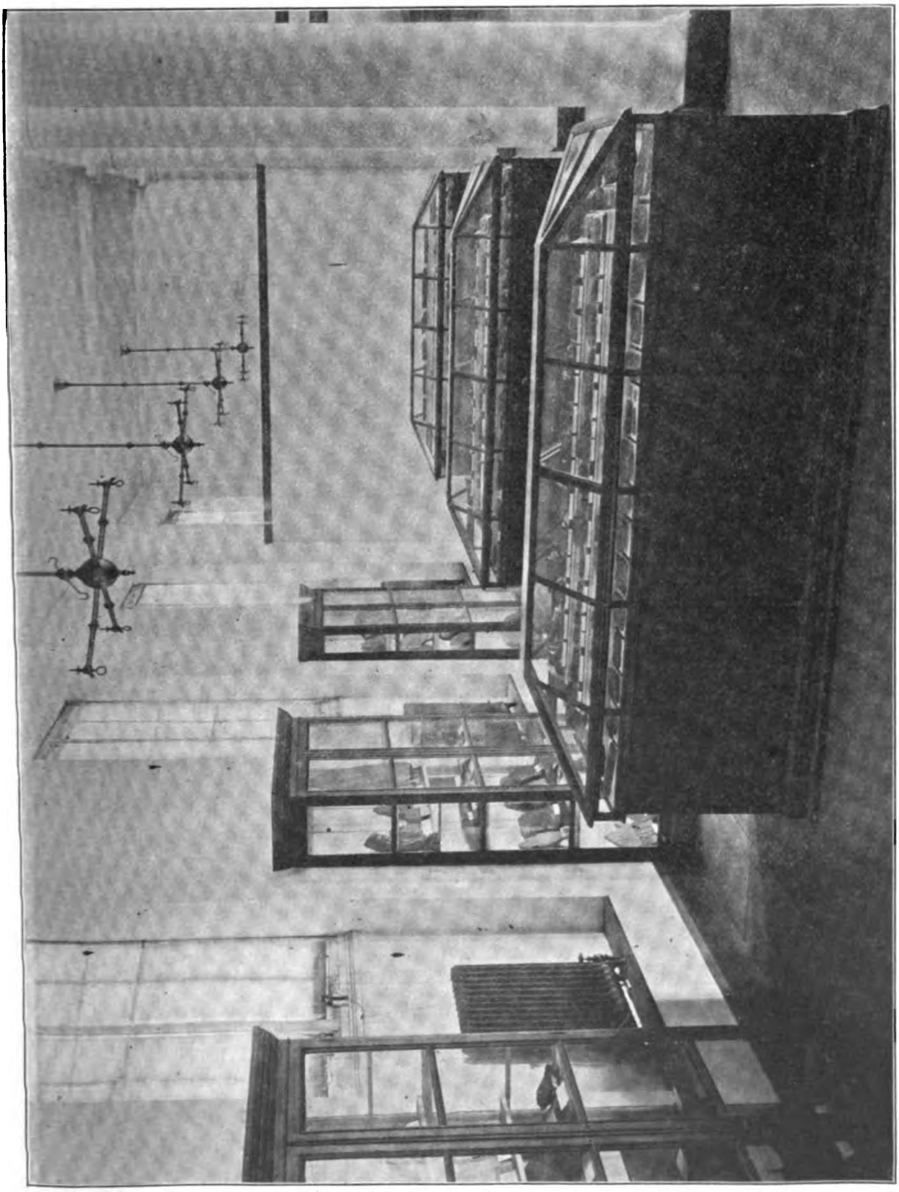


FIG. 39. View of north side, east wing of main basement floor, showing floor and wall cases Nos. 1–3.

that nearly all important works or papers on paleobotany come to the library as soon as published.

Every year students and investigators in paleobotany have availed themselves of the opportunities and advantages which the Garden supplies in this line of work, which are believed to be unequalled by any other institution in America, and which could be still further enlarged by including within their scope equipment for morphological as well as systematic work.

ARTHUR HOLLICK.
Curator.

ENRICHING SOIL BY CRIMSON CLOVER.

The value of clovers and other leguminous plants in the fertilization of soils has long been recognized but it is only within comparatively recent years that the reasons for this have been thoroughly studied.

Nitrogen which is contained in the soil in the form of compounds is necessary to the life of the plant, and although free nitrogen is present in the air in great abundance it is not available to the average plant in this form. When the nitrogen compounds become exhausted from the soil by constant use it becomes necessary to restore these through fertilizers. Although free nitrogen is not available by the average plant it has been found that certain bacteria which are known as nitrifying bacteria are able to use the free nitrogen from the air and to fix it in the form of compounds in which form it is available by other plants. These bacteria do not act alone but live as parasites on the roots of clovers and related plants where they form swellings known as nodules. Although parasites, they give in return for the sustenance which they draw from the plant on which they grow, the nitrogen so necessary to that plant. Through this adaptation leguminous plants are able to grow in soils which contain a very small amount of nitrogen compounds and to restore to the soil through their remains these compounds in sufficient quantity to supply the needs of other forms of vegetation. By the growth and the subsequent plowing under of leguminous crops it has been found that worn out soils may be fertilized at much lower cost than by other artificial means.

As noted in the JOURNAL for June an area of about half an acre of land at the rear of the museum building was graded and prepared for sowing crimson clover seed in April and May. The area was one that had to be denuded in the general grading operations around the building and a great deal of rock taken out of it, and it was subsequently covered to an average depth of about 10 inches with top-soil hauled from other parts of the grounds, affording excellent opportunity for the use of crimson clover instead of manure for fertilizing. The record of growth is as follows:

May 14, seed sown and the ground rolled.

May 20, first appearance of seed-leaves above ground.

May 30, first simple foliage leaves abundant.

June 2, tubercles on main roots nearly 1 mm. in diameter; minute tubercles on secondary roots.

June 15, plants about 2 inches high; increase in tubercles on the root system.

July 1, crop averaging 6 inches high, with proportionate increase of tubercles on the root system.

The continued and severe drought through June and July greatly retarded growth, so that not more than about one third of the full crop was obtained. A small proportion of the plants came into bloom late in July.

August 7, the crop was plowed in.

September 9, area sown with lawn mixture.

December 1, area well covered with young grass.

EXPENDITURES IN MAY.	
Plowing, team and 2 men, one day	$7.00
Harrowing and rolling, team and 1 man, ¼ day	1.25
Sowing, 1 man, ⅕ day	.40
Cost of crimson clover seed	.72
EXPENDITURES IN AUGUST.	
Plowing, team and 2 men, ¾ day	5.25
EXPENDITURES IN SEPTEMBER.	
Cost of lawn grass seed	2.00
Harrowing, sowing and rolling	4.50
Total expenses for half an acre	$21.12

The cost of thus enriching a large acreage would, of course, be considerably less, probably not more than $30 per acre.

N. L. Britton.

NOTES, NEWS AND COMMENT.

Volume 22, part 4, of North American Flora, containing descriptions of the family Rosaceae (pars), by P. A. Rydberg, was issued November 20, 1908.

Dr. and Mrs. W. A. Murrill sailed for Jamaica December 5, to study and collect fungi at various points on the island.

A plant of *Acacia platyptera* has just come into flower at the conservatories. The flowers are bright yellow and are borne on what appear to be stiff, flat leaves, but these are really branches. The plant has no true leaves, and these leaf-like branches take the place of leaves in the economy of the plant. This acacia is native in Australia, and is now in house No. 12.

The collection of orchids in house No. 15 has been of great interest for some time back, and promises to continue this interest for some weeks to come. *Dendrobium Coelogyne*, with the habit of a Coelogyne but the flower structure of a Dendrobium, has been in flower for several weeks, and is still in bloom. This is a most peculiar plant, and this is the first time it has flowered with us. Some showy oncidiums, including *O. altissimum*, will be a mass of yellow during December. The large collection of Venus-slippers, representing the genera *Paphiopedilum* and *Phragmipedium*, forming a part of the large collection of orchids presented to the Garden by Mr. Oakes Ames last year, has been attracting much attention for some time past, and the buds in sight now give promise of an interesting exhibit during December. There are in this collection a large number of hybrids, some of them of extreme beauty and attractiveness. A view of these plants would well repay any visitor to the collections.

Through the generosity of Mr. Henry Hicks, Cornell University will be enabled to establish an arboretum of about twenty acres on a tract of land recently bought from the late F. C. Cornell, adjoining the campus on the east and the new athletic field on the south. This tract lies along the sides of the Cascadilla ravine and presents a variety of soil and exposure admirably adapted for grouping trees according to their natural affinities. No attempt will be made at landcsape gardening; the contour of the ground will be left as it is, and various groups of trees will be arranged in lanes running northward and southward across this ravine. Mr. Hicks' gift will include many foreign species, notably certain hardy kinds from Japan and Manchuria.

Meteorology for November. — Total precipitation for November .42 inch. Maximum temperatures were recorded of 64.7° on the 3d, 60.3° on the 9th, 57.3° on the 20th, and 59° on the 26th and 27th; also minimum temperatures of 31.7° on the 2d, 25° on the 5th, 24° on the 16th, 25.7° on the 21st, and 34° on the 29th. The mean temperature for the month was 44.35°.

While the amount of precipitation in the form of rain was very low for the month this was in part counterbalanced by fogs and mists which kept the air saturated and prevented excessive evaporation. Heavy fogs from the 23d to the 26th kept the surface of the soil thorougly moist. This followed by very light showers but heavy mists.

ACCESSIONS.

LIBRARY ACCESSIONS FROM NOVEMBER 1 TO NOVEMBER 30, 1908.

AMES, OAKES. *Orchidaceae:* illustrations and studies of the family Orchidaceae. Fascicle III. Boston, 1908. (Given by Dr. N. L. Britton.)

ATKINSON, GEORGE FRANCIS. *Studies of American fungi.* Ed. 2. New York, 1903.

EDWARDS, SYDENHAM. *The new flora Britannica.* London, 1812.

GEIGER, PHILIPP LORENZ. *Pharmaceutische Botanik.* Zweite Auflage, neu bearbeitet von T. F. L. Nees von Esenbeck und J. H. Dierbach. Heidelberg, 1839–40. 2 vols.

LINDLEY, JOHN, & MOORE, THOMAS. *Treasury of botany.* New edition. London, 1870. 2 vols.

LOCKE, JOHN. *Outlines of botany.* Boston, 1819.

MÜLLER, GUSTAV. *Mikroskopisches und physiologisches Praktikum der Botanik für Lehrer.* Zweiter Teil: Kryptogamen. Leipzig, 1908.

NUTTALL, THOMAS. *An introduction to systematic and physiological botany.* Ed. 2. Cambridge, 1830.

PATTERSON, HOMER L. *College and school directory of the United States and Canada.* Chicago, 1908.

ROBINSON, BENJAMIN LINCOLN, & FERNALD, MERRITT LYNDON. *Gray's new manual of botany.* Seventh edition. New York, 1908. (Given by Dr. W. A. Murrill.)

SCHWEINITZ, LEWIS DAVID VON. *Synopsis fungorum in America boreali media degentium.* Philadelphia. 1832. (Given by Dr. W. C. Deming.)

Science-Gossip. Edited by M. C. Cooke & J. E. Taylor. London, 1866–77. 12 vols.

THONNER, FRANZ. *Die Blütenpflanzen Afrikas.* Berlin, 1908.

WARBURG, OTTO, & VAN SOMEREN BRAND, J. E. *Kulturpflanzen der Weltwirtschaft.* Leipzig (1908).

WILLIAMS, J. R. *Suggestions for school gardens.* Jamaica, 1908. (Given by Dr. N. L. Britton.)

MUSEUMS AND HERBARIUM.

77 specimens of hepatics from the Franconia Mountains, New Hampshire. (Given by Miss Annie Lorenz, for a committee of the Sullivant Moss Chapter.)

3 specimens of mosses collected on the Alaskan Mammoth Expedition of 1908. (Given by the American Museum of Natural History.)

1 museum specimen of *Neomeris* from Singapore. (Given by Mr. A. H. Church.)

6 specimens of the leaves of *Sassafras Sassafras.* (Given by Mr. Edwin W. Humphreys.)

4 specimens of mosses from New Hampshire. (Given by Miss Annie Lorenz.)

4 fossil specimens of *Picea canadensis.* (Given by Dr. Arthur Hollick.)

13 specimens of various fossil plants from Colorado and New York. (Given by Mr. Edwin W. Humphreys.)

11 specimens "Hepaticae Norvegici." (From the herbarium of N. Bryhn.)

5 specimens of marine algae from the Dutch East Indies. (By exchange with Mrs. A. Weber-van Bosse.)

22 specimens "Musci Canariensia." (From the herbarium of N. Bryhn.)

1 specimen of fungus from Santiago de las Vegas, Cuba. (By exchange with Mr. H. Hasselbring.)

200 specimens of Canadian mosses. (Distributed by Mr. John Macoun.)

1 specimen of *Neomeris* from the Friendly Islands. (Given by Trinity College, Dublin.)

1 model of the morel. (Given by Dr. W. C. Deming.)

1 specimen of fungus from Lancaster County, Pennsylvania. (Given by Dr. J. K. Small.)

5 specimens of resupinate polypores from Lincoln, Nebraska. (Given by Mr. R. J. Pool.)

2 specimens of *Boletus granulatus* from Biltmore, North Carolina. (Given by Dr. H. D. House.)

5 specimens of polypores from Flat Rock, North Carolina. (Given by Mr. E. R. Memminger.)

52 specimens of marine algae from Pacific Island and Australia. (By exchange with Maj. Th. Reinbold.)

SEEDS AND PLANTS.

5 palms for conservatories. (Given by Hon. W. G. Choate.)

2 plants of *Phyllocactus* for conservatories. (Given by Mrs. M. Mott.)

1 fern for conservatories. (Given by Mr. C. Lanier.)

1 plant of *Paphiopedilum Fairieanum* for conservatories. (By exchange with Mr. J. A. Manda.)

3 plants of *Stylophyllum* for conservatories. (Given by Miss E. M. Wickes.)

3 plants of *Aralia* for conservatories. (By exchange with the Department of Parks, Borough of the Bronx.)

5 grafted cacti for conservatories. (Given by Mr. Henry Schmidt.)

529 plants for the woody collections. (Purchased.)

3 packets of choice *Althaea* seed. (Given by Miss W. A. Compton.)

14 packets of *Crataegus* seed. (By exchange with Mr. B. F. Bush.)

19 plants derived from seed from various sources.

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Vol. IX DECEMBER, 1908 No. 108

JOURNAL

OF

The New York Botanical Garden

EDITOR

WILLIAM ALPHONSO MURRILL

Assistant Director

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